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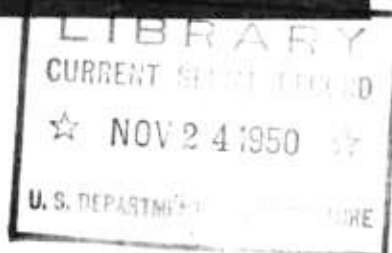
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Rabbit

PRODUCTION



Farmers'
Bulletin
No. 1730



RABBITS ARE RAISED for food and fur in all parts of the country, but their value in supplementing the family meat supply or in adding to the farm income is recognized in some sections more than in others. The pearly white meat is highly nutritious and palatable and can be served throughout the year. Rabbitskins are used extensively in the hat trade and in making fur garments. No animal is better adapted for 4-H Club, Future Farmer, and Boy Scout work.

Improved methods of managing, feeding, and breeding rabbits are being studied at the United States Rabbit Experiment Station, Fontana, Calif. The newer methods of selective self-feeding of whole grains, properly balanced with a protein supplement, have materially reduced the cost of production.

This bulletin was first issued as a contribution from the Bureau of Biological Survey, which in 1940 was consolidated with the Bureau of Fisheries to form the Fish and Wildlife Service, United States Department of the Interior. That Department revised the bulletin and issued it as Conservation Bulletin 25, **Rabbit Raising**. With the transfer of investigations in fur farming and domestic rabbits back to the Department of Agriculture, in 1946, the bulletin was reissued with the same contents but under the original title and number.

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3 RABBIT PRODUCTION¹

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INTRODUCTION

Rabbits are grown successfully in every State in the Union. The industry has been making steady growth for a number of years,

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receiving special impetus during World War II through the increased demand for meat. It is estimated that 24 million domestic rabbits were raised in 1944, the peak year of production. More than 40 million pounds of domestic rabbit meat is being consumed annually in the United States and the demand is growing. The center of rabbit population is in southern California. In Los Angeles alone, 15 million pounds of rabbit meat was processed in 1948. Packaged quick-frozen fryers were shipped by carlots to eastern markets.

Production of Angora rabbit wool increased rapidly during the war years, but it has diminished since. Cloth and blankets are manufactured from Angora wool mixed with other fibers.

Rabbits are excellent animals for 4-H Club, Future Farmer, and Boy Scout projects. They also make ideal pets and will continue to be raised as a hobby. The industry lends itself to a wide range of possibilities, from small back-yard units of 3 or 4 hutches to large commercial rabbitries of several hundred hutches.

RABBIT MEAT AS FOOD

In the West a market for rabbit meat is well established. Trucks make regular trips to rabbitries to pick up market animals and deliver them to central slaughterhouses. The meat is available at butcher shops and is served regularly at restaurants, hotels, and hospitals. In other parts of the country, few places display the meat or offer it regularly for sale; it is produced chiefly for home and local consumption and the general public is not well acquainted with it. Once constant supplies are available, however, and the good qualities recognized, the demand may increase.

Domestic rabbit meat is pearly white, fine-grained, nutritious, and palatable. The size of the carcass and quality of the meat make it a convenient form of fresh meat throughout the year. It has practically the same food value as beef, pound for pound.

RABBITSKINS FOR FUR

Regardless of size and color, all rabbitskins have commercial value. The better grades are dressed, dyed, and sheared (although some skins are used with the long hair) and made into fur garments and trimmings for women's coats, suits, and dresses. Skins not suitable for garments are used as linings for men's and boys' gloves, for toys, and in the manufacture of felt hats. Even the fine shreds into which the skins are cut in separating the fur for felt are utilized in the manufacture of glue.

In varieties known as rex rabbits (page 19), the normal guard hairs are absent or are shorter than the underfur. Such skins need not be sheared; if the natural colors are satisfactory, they need not be dyed. However, mechanically sheared and dyed normal skins usually have greater uniformity than fur from rex animals.

RABBITS FOR LABORATORY PURPOSES

The demand for rabbits for laboratories and for biological purposes offers opportunities to breeders living near hospitals and laboratories. Anyone who desires to raise rabbits for such purposes should find out from city or county health officials, laboratories, and hospitals in the vicinity the type, age, and size of animals desired.

WOOL PRODUCTION BY ANGORA RABBITS

Raising rabbits for wool is a comparatively new phase of the industry; its future will depend on a satisfactory margin between cost of production and dependable market values.

Angora rabbits are sheared or plucked four or five times a year, and a good commercial herd should produce about 14 ounces of wool per animal in a year.

The wool is unusually warm and light when made into garments, but, owing to its cost and fluffiness, it is used mostly in conjunction with other fibers. The fiber is of a fine texture and takes the delicate pastel shades of dye.

UNITED STATES RABBIT EXPERIMENT STATION

The recommendations made in this bulletin are based largely on findings at the United States Rabbit Experiment Station, maintained at Fontana, Calif., by the Bureau of Animal Industry, Agricultural Research Administration. At this station improved methods are developed for producing rabbits with meat, fur, and wool of fine quality, for insuring sanitary surroundings, and for preventing outbreaks of parasitic and other diseases. The fundamental principles developed are applicable in any section of the country.

The equipment of the station, on the site of a 5-acre orange grove, includes an administration building containing offices and laboratories (fig. 1); the superintendent's residence; various open and closed types of houses sheltering hundreds of hutches and cooled on hot days by a sprinkler system; storage houses, in which hay and grain are kept and prepared for feeding; a carpenter shop; a garage; and a small slaughterhouse. From 1,000 to 1,200 rabbits are used at a time in the various experiments, or an aggregate number in excess



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Figure 1.—Administration and laboratory building, United States Rabbit Experiment Station, Fontana, Calif.

of 4,000 in the course of a 12-month period. Thousands of rabbit breeders and other interested persons from different sections of the United States and from foreign countries visit the station each year. Fontana, in San Bernardino County, is 50 miles east of Los Angeles, and can be reached by Pacific Electric busses, the Santa Fe Railroad, and United States Highways 66 and 99.

CHOOSING A BREED

A prospective rabbit breeder should first determine in which phase of the industry he wishes to engage—whether in meat and fur, wool, laboratory animals, or fancy stock—and then select the breed best adapted to his needs. Mature animals of the smaller breeds weigh 3 to 4 pounds each; those of the larger breeds, 14 to 16 pounds. In color, also, there is wide variation.

The American Rabbit and Cavy Breeders Association has set up 62 standards for breeds and varieties of rabbits, but the beginner in commercial production should make his selection from only 6 or 8 breeds. Fine distinctions will confuse him, and from a utility standpoint a large number of breeds and varieties will be a handicap to the development of his own business and to that of the industry. The rabbits best suited in size and conformation to the production of meat and fur are such medium and larger breeds as New Zealand, Californian, American, Beveren, Champagne de Argent, Chinchilla, and Flemish Giant. White rabbits that are satisfactory meat producers are most desirable (fig. 2), because their skins usually bring higher prices. The preference among white breeds is largely a matter of personal choice.



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Figure 2.—A New Zealand White doe and her healthy, vigorous, good-type litter.

SELECTING FOUNDATION ANIMALS

The beginner in rabbit raising may start with young rabbits just weaned or with mature animals. When young are used for foundation stock, the breeder has opportunity to become acquainted with his animals and their habits before they reach the production stage. It is best to begin on a small scale, with 1 buck and 2 to 10 does, for example, and expand operations as experience and market demands justify.

When buying breeding stock, it is better to deal directly with reliable breeders; brokers handling live rabbits are seldom able to vouch for the conditions under which their animals were produced.

Reliable breeders stand behind the stock they offer and will give references. National, State, and local rabbit-breeders' organizations can furnish names and addresses of breeders from whom stock can be purchased, and further inquiries can be made of local chambers of commerce and better-business bureaus. It is contrary to Government policy to vouch for the integrity or the financial standing of any individual or company. The Rabbit Experiment Station is purely a research agency and does not sell breeding stock.

The essential requirements of good foundation stock are: Health and vigor; longevity; ability to reproduce profitably; and type and conformation consistent with ability to produce marketable offspring of the desired quality and size. Animals deficient in vitality, even though free from disease, cannot be expected to produce young profitably.

FEEDS AND FEEDING

The cost of feed is one of the largest items of expense in raising rabbits. In planning for economical production, therefore, a breeder should give careful consideration to home-grown crops that may be fed with purchased dietary supplements, commercially prepared mixtures, and pellets. He should select rations that are suitable to the needs of the animals. Each herd of rabbits presents an individual feeding problem. The kind of ration to be used will be determined largely by the purpose for which the rabbits are kept. The amount of time the breeder has available for preparing and feeding the ration also is an important factor in selection of the kind to use.

To maintain health and produce good meat, fur, and wool, rabbits must be given wholesome feeds that they relish. Only good-quality fresh feed should be used.

SUITABLE TYPES OF FEEDS

Rabbits consume a variety of feeds, and a large number of crops grown in different sections of the United States are suitable for making up satisfactory rations. Feeds have been classified in the following groups to aid the breeder in making up rations for his herd.

For all practical purposes, any feed in one group may replace another feed in the same group without materially changing the nutritive value of the ration.

Carbohydrate Feeds

Oats, wheat, barley, the grain sorghums (milo, feterita, hegari, kafir, and sagrai), buckwheat, and rye may be used as whole grains or as milled products. The softer varieties of corn may be fed whole, but there will be considerable waste of the flinty varieties unless they are fed in meal or cracked form.

Milled-wheat products—bran, middlings, shorts, and red-dog flour—and byproducts from manufacturing foods from other grains for human use may be included in mash mixtures and pellets.

Vegetable-Protein Feeds

Soybean, peanut, sesame, and linseed meals, which are rich in protein, are desirable for balancing rabbit rations. The selection of a protein will depend on availability and cost.

Fresh plant-protein supplement is distinguished by its nutty odor and flavor. Proprietary pelleted rations do not contain enough protein to permit their use as a protein supplement in a grain ration.

Although soybean seeds have approximately 36 percent of protein and 18 percent of fat, the meal from the seeds, with fat extracted, has as much as 45 percent protein and 1 to 5 percent fat. Where there are oil mills the seeds often can be exchanged pound for pound for the meal with higher feeding value. The seeds are not very palatable; consequently rabbits will consume only about 1 pound of them for each 10 pounds of grain. This proportion of soybeans will improve the protein content of a whole grain-legume hay ration slightly but not enough for maximum growth.

Miscellaneous Feeds

Dry bread and other table and kitchen waste (except meat and greasy and sour foods) are acceptable to most rabbits, and when used as supplements to grain and roughage or pelleted rations will add variety to the rabbit's diet. Cow's or goat's milk may be used in rations when the cost is not prohibitive, but exceptional care should be taken to prevent its becoming sour or contaminated and causing digestive troubles. Dry bread mixed with milk is a satisfactory feed for does with young litters and for rabbits being conditioned for shows.

Legume Hays

The legume hays—alfalfa, clover, sweet clover, lespedeza, cowpea, vetch, kudzu, soybean, and peanut—are palatable and make good feed for rabbits. Hay for rabbits should be fine-stemmed, leafy, green in color, well-cured, and free from mildew or mold.

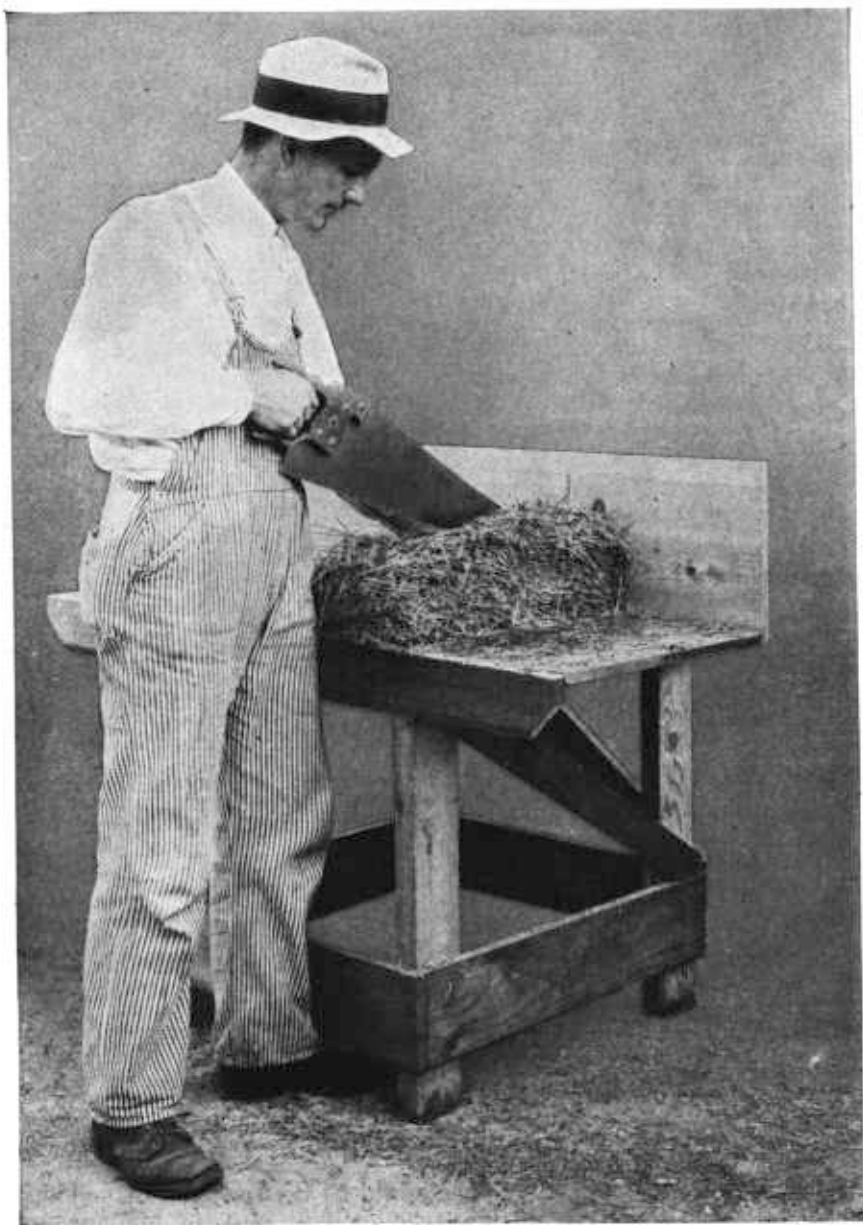
If coarse hay is fed whole, a good deal will be wasted, because the rabbits will pull a stem out of the hay manger, eat part of it, and drop the rest. To prevent this wastage and to put the hay in a more convenient form for feeding, cut it into 3- or 4-inch lengths. Convenient home-made equipment for cutting hay is shown in figure 3. This method eliminates excessive dust and leaf-shattering that would occur if the hay were chopped.

In preparing baled hays for use in large quantities, a hay knife saves time and labor. The bale is placed on a slatted platform (fig. 4) for convenience in cutting, and the hay is cut parallel to the baling wire. Hay-cutting equipment, both hand- and power-driven is available at hardware and implement stores.

Carbonaceous Hays

The carbonaceous hays—composed of grasses such as timothy, Johnson, prairie, Sudan, Dallis, Rhodes, Bermuda, and Carpet—are less palatable than legume hays, but are valuable for feeding where legume hays are not readily available.

The grass hays ordinarily contain only about half as much protein as legume hays; consequently, when they are fed more protein supplement must be included in the ration. If cut before the plants are in bloom, when the stems are fine and there is a high proportion of leaf, the grass hays will be much more suitable for feeding rabbits, principally because of the higher protein content. Even so, they do not contain as much as legume hays.

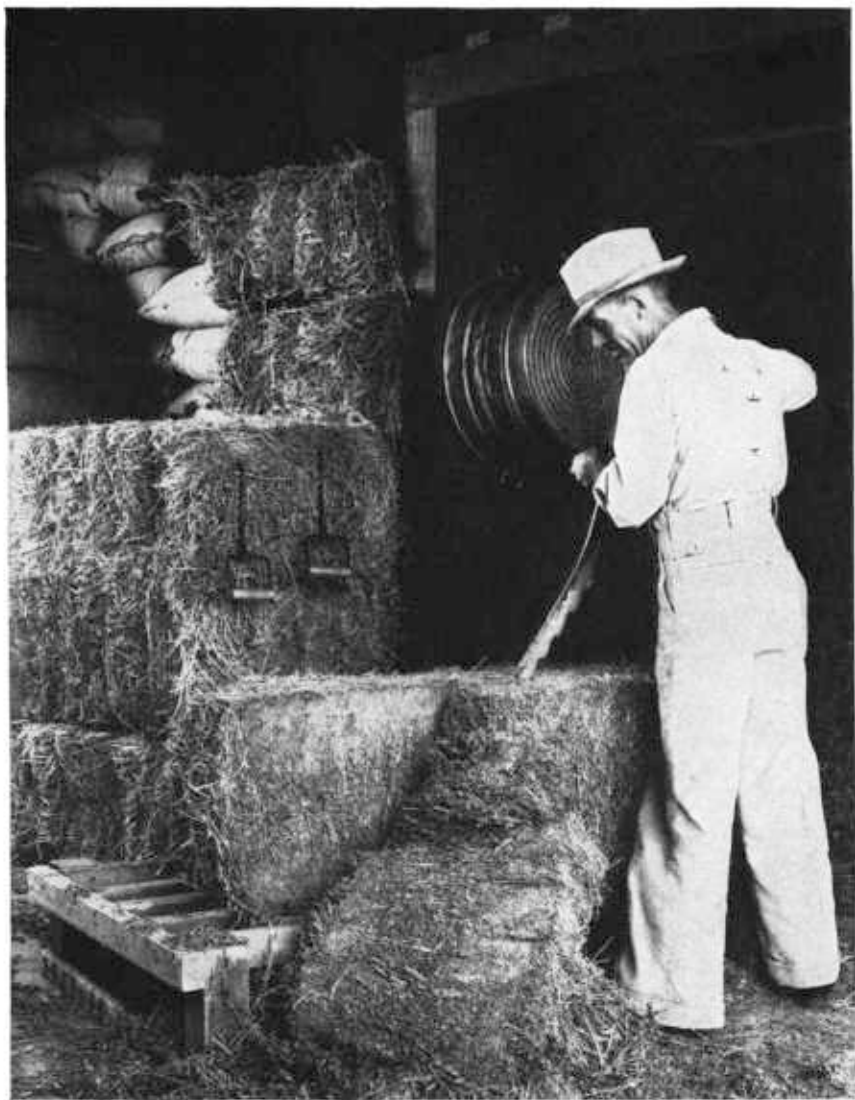


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Figure 3.—A cheap and convenient device for cutting hay into short lengths. The bench top has a slot for guiding saw.

Green Feed and Root Crops

Rapid-growing plants—grasses, palatable weeds, cereal grains, and leafy garden vegetables—are high in vitamins, minerals, and proteins,



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Figure 4.—A hay knife saves times and labor in cutting baled hay.

and make excellent feeds. They should be used when reasonable in cost and when their use in the ration will fit into the management program. Such feeds are especially valuable for the breeding herd. It does not pay, however, to buy green feed if the ration contains 40 to 50 percent of leafy, fine-stemmed green alfalfa hay such as that produced on irrigated land and known as desert hay.

Root crops—carrots, sweetpotatoes, turnips, mangels, beets, and Jerusalem artichokes—make desirable feed throughout the year, but particularly in winter, when green feeds are not available.

Green feeds and root crops are of greatest value when fed fresh as a supplement to the concentrate part of the ration. They should be given once a day in an amount that will be consumed in 4 or 5 minutes. As such feeds contain 90 percent or more of water, they should be fed with grain or pellets in producing choice carcasses. However, green feeds may be used to maintain mature animals that are not in production.

If rabbits are unaccustomed to green feed and root crops, these feeds should be fed sparingly. There is no danger in feeding fresh green feed that is wet with dew or rain, but if it has been allowed to stand in piles and become heated there is.

Feed should be placed in the hay manger, never thrown on the floor of the hutch. Contaminated feed may cause digestive disturbances or infest rabbits with eggs of internal parasites. Any feed not readily consumed should be removed.

Salt

Salt is necessary in the ration. In areas where the soil is deficient in certain mineral elements, mineralized salts such as are fed other farm animals may be used in rabbit rations.

Small blocks of salt or salt spools may be placed in the hutch so that the animals can feed at will. Salt may also be incorporated in the mixed feed or in the pellets. If hay makes up 50 percent by weight of the ration, the concentrate mixture should contain 2 percent of salt. Some rabbit raisers supply salt by both methods.

Minerals and Vitamins

Little definite information is available concerning the mineral and the vitamin requirements of rabbits. Unquestionably, a mineral or a vitamin deficiency is less likely to occur if the animals are supplied with a wide variety of feeds that include two or more grains, a plant-protein supplement, a good-quality legume hay, green feed or root crops, and salt. It is especially important that the legume hay be bright green in color and leafy and that the green feed or root crop be fresh and sound.

Water

Rabbits need ready access to plenty of fresh, pure water at all times. In summer, they require large quantities; a 10- to 12-pound doe and her 8-week-old litter of seven will drink about a gallon of water in 24 hours.

An automatic watering system provides a constant supply of fresh water and saves time and labor. It is adapted for use in areas where exposed water pipes will not freeze. It may also be used for several months each year in colder climates, or the year round if the pipes are in a building that protects them from freezing.

Water should not be allowed to siphon from hutch to hutch. The waterer should be of a type that is easy to keep in repair, with no surfaces to collect dirt and fur.

Certain types of pressure tanks are used in automatic waterers obtainable from rabbit supply houses and should be installed a few inches above the supply pipe. The water valves should be 9 inches above the level of the hutch floor. Young rabbits can obtain an ade-

quate supply of fresh water, and this height is also convenient for mature animals (fig. 5).

When freezing temperatures prevail in the rabbitry, the rabbits should be offered water (not too cold) in crocks, at least once a day, just previous to feeding. The crocks should then be emptied to prevent freezing. Coffee cans are often used in winter, as ice can be broken and removed from them easily.



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Figure 5.—Young rabbit drinking from an automatic waterer. The wire mesh has been cut and bent to make the valve accessible to the rabbits. As the valve is outside of the hutch, water will not drip on the rabbits or on the floor of the hutch.

FEED REQUIREMENTS OF RABBITS

Rations for dry does, herd bucks, and developing young should provide the following:

	Percent		Percent
Protein.....	12 to 15	Nitrogen-free extract.....	43 to 47
Fat.....	2 to 3.5	Ash or mineral.....	5 to 6.5
Fiber.....	20 to 27		

Rations for pregnant does and does with litters should contain more protein. Their rations should include:

	Percent		Percent
Protein.....	16 to 20	Nitrogen-free extract....	44 to 50
Fat.....	3 to 5.5	Ash or mineral.....	4.5 to 6.5
Fiber.....	14 to 20		

The protein content of the rations is important in the development of the young for maintaining the breeding herd and for wool production, and is a factor in the quantity of food required for a certain gain in live weight. Adding the proper quantity of protein supplement to a ration composed of grains and hay increases the rate of growth of

young rabbits 13 to 20 percent and effects a saving of 20 to 25 percent in the quantity of feed required for a unit of gain.

Protein is the most expensive part of the feed, but the proportions recommended are those that have proved most economical. The upper limits suggested give better results than the lowest, and there is no danger in feeding higher levels of protein than recommended, provided the ration is adequate in all other ingredients. Consequently, in small herds of rabbits, or where management practices make it inadvisable to feed two rations, feed intended for pregnant does and for does with litters can be given to the entire herd.

TYPICAL RATIONS

Dry does, herd bucks, and growing rabbits may be fed the following: Four parts, by weight, of whole grains (two or more preferred) and one part of protein supplement in pellet or cake form, plus all that will be eaten of any legume hay, a small quantity of green succulent feed, and salt.

Pregnant does and does with nursing litters may be fed this diet with the quantity of protein doubled.

Milled products instead of whole grains may be used in the same proportions, but they must be dampened before feeding to prevent settling out and loss of the fine meals.

FREQUENCY AND PECULIAR HABITS OF FEEDING

Whether a herd of rabbits should be fed one, two, or three times a day is largely a matter of personal preference and convenience. Regularity in feeding is more important than the number of feedings. When a system has been adopted, it should be adhered to.

Rabbits eat more at night than during the day, especially in warm weather. Rabbits re-ingest part of their food, usually in the early morning, when they are unobserved. They re-ingest only the soft matter that has passed through the digestive tract but once. Investigators have called this trait of rabbits "pseudo-rumination," from the characteristic of ruminants (cows, sheep, etc.) of chewing their cud, which is food regurgitated and chewed again. Most rabbit breeders are entirely unaware of this practice and those that have observed it have believed it to be indicative of a nutritional deficiency. It is, however, an entirely normal procedure in rabbits.

The most successful breeders study the individual animal's food requirements and do not attempt to feed all in the herd alike. Some rabbits need slightly more than the average individual; some a little less. Then, too, occasionally a rabbit goes "off feed." When this happens it is well to reduce the quantity of the ration. The offer of a tempting morsel of carrot, bread and milk, or fresh green feed may induce the rabbit to begin eating again.

METHODS OF FEEDING GRAINS AND PELLETS

Hand-Feeding and Self-Feeding

Mixed whole grains and a protein supplement may be placed in standard rabbit feed crocks or feed troughs; this is called hand-feeding. Or the feed may be placed in feed hoppers (see p. 42) or in self-feeders having a separate compartment for each ingredient (see p. 43), from both of which rabbits may feed at will; such rabbits are said to be self-fed. The self-feeding systems save time and labor,

insure a more uniform quality of fryer, and prevent contamination and waste of feed.

Rabbits may be fed restricted amounts, or they may be full-fed—that is, fed all they will eat without waste. For full-feeding in crocks or troughs, two or more feedings a day are necessary; otherwise, the animals will scratch out and waste feed. With a hopper or selective self-feeder, unlimited amounts of feed may be kept before the animals at all times. A selective self-feeder supplied with the proper feeds permits rabbits to balance their own rations.

Full-feeding by hand produces about the same results as self-feeding, provided the caretaker is efficient and sees that his animals have all they will consume each day without waste. However, if the chore is likely to be neglected, self-feeding will give better results.

Full-feeding insures rapid growth and economical development of young to weaning. Full-fed rabbits require less feed to produce 1 pound of live weight, because they eat frequently and slowly and masticate thoroughly.

All-grain pellets (gray) and complete pellets (green) also may be fed by the foregoing methods.

FEEDING DRY DOES, HERD BUCKS, AND DEVELOPING BREEDING RABBITS

Mature dry does and herd bucks not in service but in good physical condition may be maintained on hay alone, provided it is a fine-stemmed, leafy, green-colored, legume hay, and fed freely. If coarse legume hays or carbonaceous hays are fed, each 8-pound animal should receive 2 ounces ($\frac{1}{3}$ cup) of a grain-protein mixture or an all-grain pellet, per day, in addition to all the hay it will consume. Herd bucks that are in service should receive the same quantity of concentrates, with free access to choice hay. The quantities should be adjusted for rabbits of other weights—for instance, a 12-pound animal should receive 3 ounces.

For developing junior bucks and does, the concentrate portion of the ration should be so regulated that the animals will make good growth and be in the desired physical condition when they are ready to be put into production. This development may be brought about by holding the grain-protein mixture or the all-grain pellet on a daily level of one-tenth of a standard measuring cup per pound, weaned weight, and allowing free access to a good-quality hay. As the rabbits develop, they will consume a larger quantity of hay to provide the additional nutrients required for growth at the desired rate.

There are on the market many brands of pelleted complete rations, in which the ingredients and their proportions vary. The breeder should follow the advice of the manufacturer as to the quantity and method for feeding.

The nutritive value of rations and the daily feed requirements of individual rabbits will vary somewhat. The breeder will note the condition of his individual rabbits and increase or decrease the quantities to obtain the desired physical condition.

FEEDING PREGNANT DOES

To feed a doe properly, it is necessary to know definitely whether she has conceived. Palpating (feeling for the developing young in

the horns of the uterus) is a quick and accurate method of determining pregnancy (see page 23).

After mating, junior and mature does in breeding condition may be maintained on a good-quality hay until they have conceived. If the doe has failed to conceive, as determined by palpation 14 days after breeding, she should be bred again and fed hay only until she does conceive.

When she has conceived, she should be given, in addition to good-quality hay, all of the concentrates she will eat for the remainder of the gestation period. Some breeders provide these concentrates in the form of grain and a protein pellet. Others prefer to buy the all-grain pellet to supplement the hay. The all-grain pellet has the necessary amount of plant protein supplement incorporated with the grain and salt to make it, when fed with a good-quality hay, a complete ration. Still other breeders, according to their situation, may wish to feed the pelleted complete feed, with which no additional feeding is required.

FEEDING THE DOE AND LITTER

After kindling, the doe can be fed in the same manner as before until the young are weaned at about 2 months of age. From the day of kindling she should have all she will readily consume without waste of a grain and protein mixture or a pelleted ration. She will require greater quantities as her capacity and that of the litter increase. Rapidly growing litters need protein. Table 1 gives a schedule for determining the approximate quantity of a grain and protein mixture that a 10- to 12-pound doe and her litter of seven will consume. For example, during the sixth week following kindling, they should be fed 20 ounces of grain and protein mixture daily—6 ounces for the doe and 2 for each of the young.

A selective self-feeder or a feed hopper (see page 42) may be provided for the doe when she kindles. If the hutch is small (less than 10 square feet of floor space for a 10- to 12-pound doe), placing a feeder or a hopper in it with the nest box would make it too crowded; it would be advisable to full-feed the doe by hand until the nest box is removed and then introduce the feed containers.

The feeders should be inspected occasionally to make sure that feed is always available.

A doe and litter should at all times have free access to hay of good quality, salt, and fresh water.

TABLE 1.—*Quantity of a mixture of grain and protein to be fed daily to a 10- to 12-pound doe and her litter of seven*

Period	Grain and protein to be fed to—		Average weight ¹ of litter
	Doe	Each of young	
	Ounces	Ounces	Pounds
Week following kindling:			
First.....	5.0	1.9
Second.....	5.5	3.5
Third.....	6.0	5.0
Fourth.....	6.0	0.75	8.0
Fifth.....	6.0	1.50	13.0
Sixth.....	6.0	2.00	18.0
Seventh.....	6.0	2.50	22.5
Eighth.....	6.0	2.75	28.0

¹ Litter of 7 averages 1 pound at birth.

A GUIDE IN BUYING COMMERCIAL FEEDS

Nearly all States have laws regulating the sale of commercial feeds. In most of them the law requires that a feed tag giving the guaranteed analysis and a list of the ingredients be attached to the sack. Usually the percentages of protein and fat must be no less than those stated and the percentage of fiber must not be greater than is guaranteed. In some States nitrogen-free extract is not listed on the tag.

Breeders can compare the analysis of the feed as shown on the feed tag with the requirements given on page 10 and select the feed that comes nearest to meeting them. If the percentage of protein in the complete pellet is below the requirements, pelleted soybean, peanut, or linseed meals or pea-size cake, may be added to give the right proportion. For example, if the complete pellet contains protein in the proportion of 13 to 15 percent, and the ration is to be fed to pregnant does or does with litters, it is necessary to add 1 part, by weight, of 40 to 44 percent protein—soybean or peanut pea-size cake or pellets—to 4 parts of the pelleted ration to bring the quantity of protein up to the 19- or 20-percent level. If linseed meal (30 percent protein) is used, $1\frac{1}{2}$ parts of pea-size cake or pellets is mixed with 4 parts of the complete pellets.

Only fresh vegetable protein supplements, indicated by a nutty aroma and taste, should be fed.

PREPARING AND STORING FEEDS

Whole grains are satisfactory for feeding rabbits. Milled products—rolled, cracked, or ground—if stored for any length of time, especially during the warm season, lose some of their food value and become less palatable.

The pea-size cake and the meal in pelleted form from soybeans, linseed, or other sources have equal nutritive value. The cake, free from finer parts, is the most convenient form for mixing such protein-rich supplements with whole grains, but where it is not available the pellets may be used. For rabbits the pellets should be $\frac{3}{16}$ inch in diameter and $\frac{1}{8}$ inch long. Mills equipped with machines can make the pellets from the meals without adding binding material. If neither the pea-size cake nor the pellets are available, it will be necessary to feed the protein as meal and to grind or crush at least half the grains used to make the mixture adhere. The whole should be dampened slightly just before feeding to prevent waste by the settling out of the meal in the feed trough.

Two types of pelleted rations are on the market—the all-grain pellet, to be fed with hay, and the complete pellet (green pellet), which usually contains all the food elements necessary for a balanced ration. Pelleted feeds are readily available in some regions; often they are the only feeds readily obtainable in urban areas. They need little storage space and are easy to feed, but are more expensive than rations composed of feeds in their natural forms.

Hay need not be cut unless it is coarse. Cutting coarse hay into 3- or 4-inch lengths makes it more convenient to feed and reduces waste. Cutting the hay to be fed to Angoras helps keep the wool clean.

Sometimes money can be saved by storing home-grown feed or feed purchased as it is being harvested. Feeds must be stored in rodent- and insect-proof containers.

BREEDING

AGE TO BREED

The proper age of bucks and does for the first mating depends on breed and individual development. The smaller breeds develop more rapidly and are sexually mature at a much younger age than the medium-weight or giant breeds. Does should be mated when coming into maturity. Some difficulty may be experienced in getting them bred if mating is too long delayed. On the average, the smaller breeds may be bred when the bucks and does are 5 to 6 months old; the medium-weight breeds at 7 months; and the giant breeds at 9 to 12 months. Some individuals within a breed develop more rapidly than others; therefore, in determining the proper time for the first mating, maturity of the individual is more important than age.

GERM CELLS AND FERTILIZATION

The female egg cells, which are microscopic in size, develop and are released into the Fallopian tubes and uterus through ruptures in the walls of the ovaries. In the rabbit, several egg cells are usually released at one time; consequently, the size of the litter is determined by the number that mature, are fertilized at a given period, and develop to birth. The rabbit differs from many other animals in that the act or excitement of breeding is required to cause the eggs to be released. Reproduction begins when the egg cells are fertilized by the sperm cells. The fertilized eggs become attached to the walls of the uterus, where they develop.

At each mating a vigorous normal buck deposits many thousands of sperm cells, which are much smaller than the eggs. The excessive number produced is a provision by nature to insure fertilization, for only one sperm cell unites with one egg cell. Consequently, more than one service to supply additional sperm cells is not necessary. Two or more services will not overcome a difficulty that prevents conception. Moreover, there is a distinct disadvantage in allowing more than one service, for excessive use lowers the buck's vitality.

GESTATION PERIOD

The gestation period, or the period from mating to kindling, is 31 or 32 days. A very small percentage of litters may be kindled as early as the twenty-ninth day or as late as the thirty-fifth, but 98 percent of the normal litters will be kindled between the thirtieth and thirty-third days.

BREEDING SCHEDULE

The breeding schedule to be followed is determined by the type of production. It would probably be better not to attempt to produce more than two or three litters a year in raising animals for show purposes. The time for matings should then be so arranged that the offspring will be of proper age and development for the show classi-

fication. In commercial production for meat and fur, breeding animals should be worked, if possible, throughout the year. Matings can be spaced to distribute labor at kindling and to avoid kindlings on a given day. With a gestation period of 31 or 32 days and a nursing period of 8 weeks, a doe can produce four litters in a 12-month period if no failures, or "passes," occur.

Where extreme temperatures make it undesirable to have litters kindled during 2 or 3 months of the year, does may be rebred 42 days after kindling and still produce four litters. Does of heavy producing strains can be mated 6 weeks after kindling, and, if no failures occur, will produce five litters in a year.

If a doe is full-fed a properly balanced ration during lactation, she should be in condition for breeding when the litter is weaned. If, however, upon weaning the litter, the doe is not in good physical condition, she should be allowed to rest until she has regained proper breeding condition. If the litter is lost at kindling but the doe is in good breeding condition and shows no signs of disease, she may be rebred in a day or two. If the size of the litter is materially reduced for any other reason, the doe may be rebred earlier than called for by the regular schedule.

FACTORS THAT LIMIT CONCEPTION

Among the causes of failure to conceive are sterility and false pregnancy. Factors that result in a low percentage of conception include extreme age, poor physical condition, sore hocks, injuries, and disease.

Sterility

Early spring is the normal breeding season for the rabbit; consequently, the percentage of conceptions will be higher at this time of the year than at others. Production drops materially during the fall, usually in August, September, and October in southern California. In extreme cases no young are produced for 4 to 5 months. The ovaries of the does become inactive during the barren period and fail to produce normal egg cells; occasionally the ovaries shrivel. In some cases where the bucks are not settling the does, the sperm cells are inactive or are absent.

Individual rabbits vary markedly as to duration of the barren period. Does and bucks in some herds are fertile throughout the year for successive years. Other herds go through periods of 4, 8, or 10 weeks when the does will not conceive. Extreme cases in which no young are produced for 4 to 5 months, usually occur in herds that are out of condition because the ration has been inadequate in quality, quantity, or both. If the herd has been properly cared for, the majority of bucks and does should complete the barren period in 4 to 6 weeks.

In view of the fact that does and bucks vary so much with respect to breeding, a rabbit raiser may well consider this factor carefully in selecting breeding stock, and make his choice from offspring of parents that produce regularly.

False Pregnancy

Does may be bred or stimulated sexually and shed the egg cells but fail to become pregnant. False pregnancy may be due to an infertile mating or to sexual excitement caused when one doe rides another.

Whether riding or ridden, does may become "false pregnant" and be unable to conceive until the false-pregnancy period is over. The period lasts for 17 days. After 18 to 22 days the doe may give evidence of the termination of false pregnancy by pulling fur and attempting to make a nest. Does that have been kept in groups should be separated and each put in a pen by itself 18 days before mating.

Age

Young does may not be sexually mature at the time of service, and old does may have passed their period of usefulness and fail to conceive. The first mating should not be attempted until the does are sexually mature and properly developed. The proper age for first mating was discussed on page 15. Does should reproduce satisfactorily as long as they maintain good physical condition and satisfactorily nurse their litters. They should be retained if younger and better stock is not available for replacements. In commercial herds, does properly cared for should breed until they are 2½ to 3 years old. Occasionally, individuals may reproduce satisfactorily for 4 to 6 years.

Physical Condition

Does and bucks that are abnormally fat or thin will have their breeding powers impaired materially or may become temporarily sterile. The condition should be corrected by adjusting the ration and delaying breeding until the animals are in proper condition.

Sore hocks and injuries that affect a rabbit's vitality should be corrected before mating is attempted. When does are out of condition, the percentage that conceive is low.

Rabbits should never be mated when they show any symptoms of disease. Remove such animals from the herd and hold them in quarantine until they have completely recovered.

INBREEDING

Inbreeding, the mating of closely related individuals, such as parents and progeny or brothers and sisters, is not usually advisable, for the following reasons.

Inbreeding knows no favorites. It intensifies poor qualities just as readily as it does good ones. The average breeder is unable to judge exceptional qualities in his breeding stock and usually lacks the knowledge of the previous history of his animals necessary to know what results to expect.

Because rabbits of the average breeder are usually of mixed genetic inheritance, even though good representatives of a given breed, inbreeding such animals will always result in progeny of varying differences within breed limitations. In itself, inbreeding is not harmful, but it is sure, rapid, and effective in revealing the genetic structure of living forms. It will always remain a most potent procedure in developing and improving any breed of rabbits; in fact, no procedure other than a close mating of individuals carrying the maximum of good qualities, with rigid selection, can be relied upon unfailingly to fix a type. However, the ordinary rabbit raiser cannot afford to practice inbreeding, as it involves elimination of all animals carrying undesirable characteristics.

LINE BREEDING

Line breeding is the same in principle as inbreeding, except that the matings are made with animals that are not so closely related. Consequently, the characteristics of mated individuals, whether desirable or undesirable, are not fixed in the offspring so rapidly as when inbreeding is practiced. Probably most attempts by the novice at inbreeding or line breeding are made to avoid buying a new buck. Rather than take chances of obtaining inferior offspring by making close matings, it would be better to purchase a new buck of the desired type when it is necessary to breed does that are related to the herd buck.

CROSS BREEDING

Crossbreeding is the practice of mating a purebred rabbit of one breed with a purebred rabbit of another. This form of breeding is adapted principally to the production of new strains and should be attempted only by experienced breeders.

IMPORTANCE OF HEREDITY

A few fundamental principles of breeding evolved from years of scientific study and observation should be noted carefully. Present evidence indicates that environment has little to do directly with improvement of animal form and that proper care and management practiced over several generations have no cumulative effect in developing a better breed of rabbits. Good feeding and care do, however, have the indirect value of providing a basis on which to select individual rabbits that because of their heredity will respond most satisfactorily.

If improvement in rabbits is brought about, it must come chiefly through the hereditary factors transmitted through the germ cells. Effort, therefore, should be concentrated toward so mating animals as to recombine the factors in more desirable forms.

Thousands of factors, called genes, determine the inheritance of each individual. The genes are arranged in groups like beads on a string, or like little packets. The groups are called chromosomes. The number of chromosomes, which are microscopic, in each cell is definite for each species. In the rabbit it is 44, made up of 22 pairs. One of each pair comes from the father and the other from the mother.

The numerous breeds of rabbits, differing in size, color, and form, have resulted from various more or less stable combinations of the chromosomes. Frequent new combinations account for the cropping out of off-type individuals within a breed and explain the extreme variability in the newer breeds as compared with older breeds that have eliminated most of the variable factors. The chromosomes frequently exchange genes. This regrouping permits various recombinations, which are at once the hope and the despair of animal breeders. Without such variations there is no chance of improvement; with them there is no assurance of fixing a type without constantly selecting animals with desirable factors and discarding those with undesirable ones.

Another form of variation, known as mutation, though less common and less important from the breeder's standpoint, has produced types of some of the most important commercial varieties of rabbits,

for example, the rex type, in which the guard hairs are either shorter than the underfur or entirely absent. Rex is recessive to the normal coat, and consequently a normal-haired rabbit may possibly be a carrier of rex. Any breed can be "rexed" within three generations by proper matings, if a sufficient number of rabbits are produced. When the offspring of a normal-haired rabbit and a rex-appearing animal are bred together, 25 percent of the litter will be pure rex, and if those of a New Zealand White and a Castorrex are mated, about 1 out of 16 of the offspring will be both white and rex.

Woolly, or long hair, is another mutation in rabbits, but unlike the rex, is an undesirable trait. Woolly in rabbits is also a recessive. Consequently any rabbit that is suspected of having the woolly character can be tested by mating it with a woolly-appearing rabbit or an Angora (and therefore pure for this character). If any young rabbits produced from this mating show the woolly character, one can be certain that the animal being tested is a carrier of woolly, even though it appears normal-haired. Neither it nor the young should be used in breeding. A rabbit with the woolly character is different in appearance from the Angora rabbit, although the genetic factor is identical with the factor responsible for the Angora characteristic.

MANAGEMENT PRACTICES

Just as in any business, success in raising rabbits depends upon efficient management. First of all the rabbit raiser should become thoroughly acquainted with his animals—their characteristics and behavior, their likes and dislikes. Consideration for the welfare of animals is always necessary for success in raising them. Proper arrangement of equipment, hutches, and buildings is also essential to efficient management.

METHODS OF HANDLING RABBITS

Rabbits should never be lifted by the ears or the legs. Handling in this manner may cause injury.

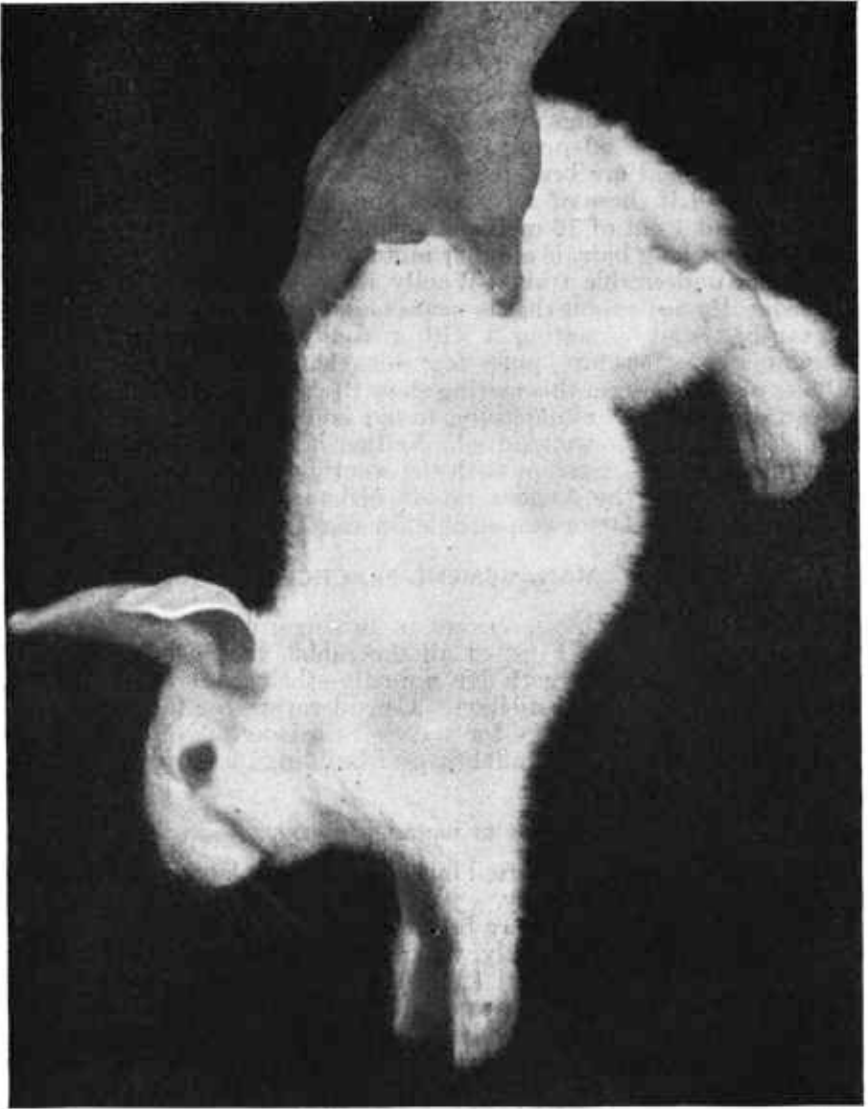
Fryer or small rabbits may be lifted and carried comfortably by grasping the loin region gently, yet firmly, the heel of the hand being toward the tail of the animal (fig. 6). This method prevents bruising the carcass or damaging the pelt.

Medium-weight rabbits may be lifted and carried by grasping with the right hand the fold of skin over the shoulders, the back of the rabbit being toward the body of the carrier, and placing the left hand under the rump to support the weight of the animal (fig. 7).

Heavy rabbits may be carried comfortably and kept from struggling and from scratching the caretaker by grasping the fold of skin over the shoulders with the right hand, and lifting and holding the rabbit against the left side of the carrier with its head under his left arm, his forearm being extended along the side of the animal, with his hand under its rump to support its weight (fig. 8).

MAKING MATINGS

Does give evidence of being ready for mating by restlessness, nervousness, efforts to join other rabbits in nearby hutches, and rubbing the chin on feed mangers and water crocks. This condition continues



B56842

Figure 6.—How to lift a fryer rabbit to prevent bruising the carcass or damaging the pelt.

for some time, and as the rabbit has no regularly recurring heat period, matings may be made over a period of time, provided the does are in proper breeding condition. Before mating, both the doe and the buck should be examined to make sure that they are free from disease.

Rabbits can be bred so as not to kindle on Saturdays and Sundays. A large number of does can be bred at one time to make quantities of fryers available at a certain season for the trade, or breeding can be spaced to produce a constant supply.



B56843

Figure 7.—How to lift a medium-weight rabbit.

The doe should always be taken to the buck's hutch for service. The hutches should be conveniently located in the rabbitry to save time and labor. Difficulty is often experienced if the buck is taken to the doe, because the doe is likely to object to having another rabbit in her hutch and may savagely attack and injure the buck. Bucks are slow also in performing service in a strange hutch. Mating should occur almost immediately on placing the doe in the buck's hutch. After the buck mounts and falls over on his side, mating is accomplished, and the doe should be returned to her own hutch.

It is difficult to get some does to accept service. Such does must be restrained for mating. To restrain the doe (fig. 9), the right hand is used to hold the ears and a fold of the skin over the shoulders; the



B58844

Figure 8.—How to carry a heavy rabbit.



B49622

Figure 9.—How to restrain a doe for mating when service is not promptly accepted. Position of hands for holding the doe and supporting and elevating the hind quarters.

left hand is placed under the body and between the hind legs. The thumb is placed on the right side of the vulva, the index finger on the left side (some breeders may prefer to use the index and second finger), and the skin is pushed gently backward. This procedure throws the tail up over the back. The weight of the body is supported by the left hand, and the hindquarters are elevated only to the normal height for service.

Bucks accustomed to being handled will not object to such assistance. It is well to hold the doe in this way the first few times a young buck is used. This practice will expedite matings and insure ready service in difficult cases.

Some does that are in condition to reproduce refuse to accept service without restraint. Does mate and conceive more readily in the spring than in the fall. For example, about 26 percent of the does at the United States Rabbit Experiment Station required restraint in the spring, as compared with 53 percent in the fall. Of the does that required restraint in the spring, more than 60 percent produced young; in the fall, 30 percent.

With a little patience and practice the breeder can develop this technique to insure nearly 100-percent matings. This does not necessarily mean that all does will "kindle," that is, give birth to young, but it will help materially in increasing the percentage of those that will, for a great many matings will be made that otherwise would not have been accomplished.

One buck should be maintained for each 10 breeding does. Mature, vigorous bucks may be used once or twice a day for a short period. A breeding record should be made showing date of mating and name or number of buck and doe. (See page 28.)

DETERMINING PREGNANCY³

The common practice of determining pregnancy by "test mating" (placing the doe in the buck's hutch periodically to determine whether or not she has conceived) is not satisfactory, because some does will accept service when pregnant and others will refuse to mate when they are not pregnant. Diagnosing pregnancy by noting the development of the abdominal region and gain in flesh also is not dependable and cannot be made until late in the period.

Palpating (feeling for the developing young in the horns of the uterus with the thumb and fingers) is a quick and accurate method for determining pregnancy. The does must be handled gently.

KINDLING

A nest box with enough straw or other soft absorbent material to make a nest should be placed in the hutch 27 days after mating. A day or two before kindling the doe usually consumes less food than normally. She should be undisturbed and made as comfortable as possible. Small quantities of green feed are tempting to the appetite at that time and have a beneficial effect on the digestive system. Most

³ More information on determining pregnancy in rabbits is given in Leaflet 245, Palpating Domestic Rabbits to Determine Pregnancy, issued by the U. S. Department of Agriculture.

litters are kindled at night. After kindling, the doe may be restless and should not be disturbed until she has quieted down.

CARE OF YOUNG LITTER

On the day after kindling it is good practice to inspect the litter. Quietly place the hand in the nest box and remove any deformed, undersized, or dead young. If one is careful and quiet in making the inspection, the doe will generally not object and there is no danger of causing her to disown the young. If she should become nervous and irritable, place some tempting feed in the hutch immediately after the inspection to distract her attention and quiet her.

Litters vary in size. In the utility breeds, they usually number 7 or 8, but some may contain as many as 12 to 18. For commercial purposes, 6, 7, or 8 may be left with the doe. Does from strains that have been developed for heavy production may care for 9 young. Some of the baby rabbits from a large litter can be transferred to a foster mother that has only a small litter. Adjusting the number of young to the capacity of the doe allows more uniform development and finish at weaning time. Several does should be mated so that they will kindle as near the same time as possible. For best results, the young should not vary more than 3 to 4 days in age. After the does have kindled and settled down, the surplus young that are to be transferred should be tattooed in one or both ears in such a way that they can be identified at weaning. The nesting material is rearranged so that each litter will be protected and comfortable. Some does will be inquisitive and jump into the nest box but they will not injure the young. The scent of the human hand or of the other mother will not cause the foster mother to reject the young.

Young rabbits open their eyes at 10 to 11 days of age, and begin to come out of the nest box at about 19 to 20 days. At this time they start eating food other than their mother's milk. If young rabbits come out of the nest box before this time, they may not be getting enough mother's milk, or the nest box may be too warm. The nest box should be constructed so they will not fall out prematurely.

Eyes of baby rabbits occasionally remain closed after the age at which they normally open. Such a condition is due to infection. If discovered and promptly treated, the animals usually recover without permanent eye injury. If the lids are inflamed and incrustated, they should be bathed with tepid 4-percent boric acid solution, applied with a wad of cotton. When the tissues are properly softened, the lids can be separated with slight pressure. If pus is present on succeeding days, the eyes should be treated with a fresh 10-percent argyrol solution.

CAUSES OF LOSSES IN NEWBORN LITTERS

If the doe is disturbed by her natural enemies—cats, snakes, rats, weasels, minks, bobcats, coyotes, strange dogs, and others—she may kindle the litter on the hutch floor and they may die from exposure. Even if these predators cannot gain access to the rabbitry, if they are so close that their presence is detected by the doe, she may kindle prematurely and lose her litter. If she is disturbed after the litter is born, in her attempt to protect it she may jump into the nest box, stamp with her back feet, and mash the newborn rabbits.

Occasionally a doe fails to produce milk, and the young starve within 2 or 3 days.

Does sometimes eat their young. Such abnormal appetite is usually the result of a ration inadequate in quality or quantity or of the nervousness of a doe disturbed after kindling. Proper feeding and handling during pregnancy will do more than anything else to prevent this cannibalistic tendency. A valuable doe that destroys her first litter should be given another chance; if she continues the practice she should be sold for meat.

WEANING THE LITTER

Does that are excellent mothers will nurse their litters for 6 to 8 weeks. The young will develop more rapidly if they are left in the hutch with their mothers until they are 8 weeks of age. By that time the milk supply will have decreased and the young become accustomed to consuming other feed; weaning will be less of a shock than if undertaken at an earlier age.

DETERMINING THE SEX

Many times it is profitable to determine the sex of very young rabbits, particularly when breeders have a market for breeding or laboratory animals.

It is possible to determine accurately the sex of a day-old rabbit, but it is easier when the rabbit is 3 days old and easiest when it is 8 weeks old, or at weaning time. When it is desirable to dispose of one sex, however, it is a good plan to sex the litter and destroy the surplus on the third day.

The external organs of newborn rabbits of both sexes have very much the same appearance, so that a special technique is required to identify sex at an early age. Good eyesight and light are necessary. To prevent the persistent wiggling of the small rabbit, it must be restrained firmly, yet gently. Place it on its back in the left palm with its head extended toward the heel of the hand, using the index finger to press the tail back and down and the thumb of the left hand and index finger and thumb of the right hand to manipulate the sex parts. Press down on the sexual organ gently but with sufficient pressure to expose the reddish mucous membrane. In the buck, the mucous membrane can be made to protrude far enough to form a circle; in the doe it will protrude and form a slit that will have a slight depression at the end next to the anus.

The sexes should be separated at weaning.

MARKING FOR IDENTIFICATION

Each breeding rabbit must be marked for identification. Tattooing the ears is satisfactory and permanent and, when properly done, will not disfigure them. Instruments for the purpose may be obtained from biological and livestock supply houses. A good type of instrument has separate lugs, with a series of numerals. The lugs can be inserted into a plierlike handle. Such an instrument perforates the inner surface of the ear in one operation. India ink is then rubbed into the small holes.

An adjustable box (fig. 10) is convenient in restraining rabbits of various sizes. With this equipment, one person can do the tattooing.

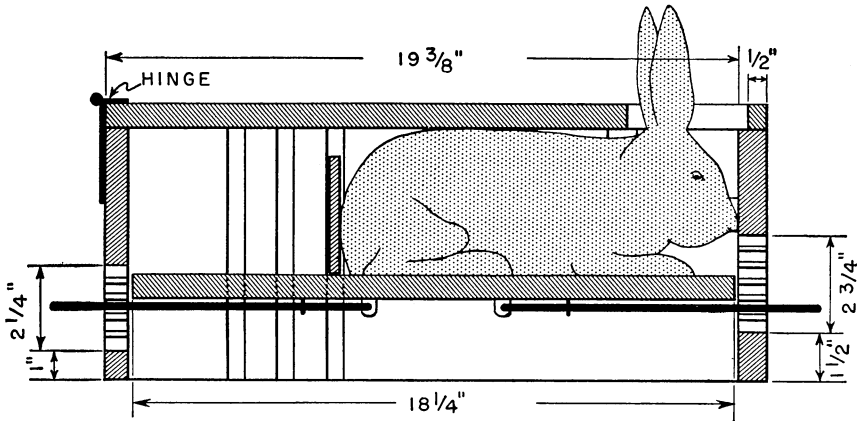


Figure 10.—Vertical section of a box for restraining a rabbit for tattooing. The spring-type holders tacked to the lower side of a movable floor will compress the rabbit toward the top of the box. A movable cross partition holds the rabbit toward the front. Blocks of wood on each side hold the rabbit's head in the center of the hole at the top.

CASTRATION

Castration of bucks may be desirable as in the case of Angoras to be kept for wool production. It is a simple operation and is most easily performed when bucks are 3 to 4 months old, but may be performed at weaning time.

To restrain an animal for the operation, an assistant should hold the left forefoot and left hind foot with his left hand and the right forefoot and right hind foot with his right hand, with the animal's back held firmly, but gently, against his lap. Clip all the wool from the scrotum. Disinfect a sharp knife or razor blade. Do not use a disinfecting agent on the rabbit. Without disinfection the animal will lick the wound frequently, keeping it clean and the tissues soft, thus promoting healing.

Press one of the testicles down into the scrotum and hold it firmly between thumb and forefinger of left hand. Make the incision parallel to the median line and well toward the back end of the scrotum to allow wound to drain readily. To prevent its being drawn up into the abdominal cavity, as soon as it comes through the incision, pull the testicle out far enough from the body for the cord to be severed just above the organ. To prevent excessive hemorrhage, sever the cord by scraping with the knife, rather than by cutting. If too much tension is put on the cord and it is drawn too far from the body, injury may be brought about by internal hemorrhage or other complication.

After the second testicle has been removed in the same manner, lift the scrotum to make sure that the ends of the cord go back into the cavity.

Handle the animal gently, and immediately following the operation place it in a clean hutch where it can be quiet and comfortable.

RECORDS AND RECORD KEEPING

A convenient and simple system of records is essential for keeping track of breeding, kindling, and weaning operations. The information can be used in culling unproductive animals and in selecting breeding stock. The essential features of a simple record system are illustrated in the hutch card (fig. 11) and the buck-breeding record card.

FORM A.H. 588

U. S. DEPARTMENT OF AGRICULTURE
Agricultural Research Administration

HUTCH CARD - U. S. RABBIT EXPERIMENT STATION

U-I

Animal No. W 475 Born 12/23/46 Breed N.Z.W.
Sire W 166 Dam W 962 Litter No. W 10234

DATE BRED	BUCK NO.	DATE KINDLED	NUMBER YOUNG BORN		NUMBER YOUNG RETAINED	LITTER NO.	DATE WEANED	NUMBER WEANED
			ALIVE	DEAD				
6/27/47	W164-	7/28/47	7	0	7	10712	9/22	7
9/19/47	W204-	10/21/47	7	0	8	11014	12/16	8
12/12/47	W204-	P						
12/26/47	W204-	1/26/48	11	0	8	11250	3/23	8
3/19/48	W164-	4/19/48	13	0	8	11504	6/14	8
6/11/48	W164-	7/13/48	7	0	8	11615	9/13	8
(A)								

PRODUCTION RECORD

LITTER NO.	WEANING			NOTES:
	NUMBER	AGE	WEIGHT	
10712	7	56	24.9	
11014	8	56	31.4	
Pass 12/24/47				
11249	8	57	29.8	
11504	8	56	30.7	
11615	8	53	26.5	
(B)				

Figure 11.—Hutch card, a useful form of record. A, front; B, back.

BUCK BREEDING RECORD

Date born.....
Genotype.....

Buck No.....
Sire.....
Dam.....

[illegible]

CARE OF HERD UNDER EXTREME TEMPERATURES

In almost all sections of the United States high summer temperatures necessitate some changes in the general care and management of rabbits. Adequate shade should be provided to protect the animals during the hotter part of the day, but rabbits should not be placed where they are totally excluded from sunlight during the cooler hours. Good circulation of air throughout the rabbitry is necessary, but strong drafts and winds should be avoided. An abundant supply of water should be available at all times.

New-born litters and does well advanced in pregnancy are most susceptible to the injurious effects of high temperatures. Heat-suffering in the young is characterized by extreme restlessness; in the older animals, by rapid respiration, excessive moisture around the mouth, and occasionally slight hemorrhages around the nostrils. Rabbits that show symptoms of suffering from the heat should be moved to a quiet, well-ventilated place. They should be given a feed sack moistened with cold water to lie on. In well-ventilated rabbitries, wetting the tops of the hutches and the floors of the houses on a hot day will reduce the temperature 6° to 10° F. The tops of hutches should be waterproof, as rabbits must be kept dry. Overhead sprinkling equipment may be used in houses with concrete or soil floors that drain readily. A thermostat-controlled sprinkler can be installed that will work automatically without daily observation.

During the summer, when it is difficult to regulate the quantity of fur in the nest box and keep the litter comfortable, a cooling basket (fig. 12) will provide relief for the young from the time they are kindled until their eyes are open and they are able to look out for themselves. This basket should be 15 inches long, 6 inches wide, and 6 inches deep. It is inexpensive, simple in design, and easy to construct. All that is needed is a piece of 1/8-inch-mesh hardware cloth

15 inches long and 18 inches wide; two $\frac{3}{4}$ -inch boards 6 inches square; and two laths 15 inches long, $1\frac{1}{2}$ inches wide, and $\frac{3}{8}$ inch thick. Tack the hardware cloth to the sides and bottom of the two square boards. The wire cloth serves as the front, bottom, and back of the basket; the boards form the ends. To prevent bending, nail the two laths lengthwise, in front and back of the basket, outside the wire, to the sides of the end boards. The top edges of the laths should be flush with the tops of the boards. At the back, insert two screw hooks in the end boards about 2 inches from the top, so that the basket can be hung up.



B56836

Figure 12.—A cooling basket hung in the hutch to provide comfort for the young during hot weather.

When the temperature is high enough to make the young restless, place them in the basket, hang it up inside the hutch near the top, and leave it for the day. In the evening, when the heat has moderated, return the litter to the nest box. Where high temperatures continue throughout the night, place the young in the nest box for a short time in the evening for nursing. Replace them in the basket for the night and allow them to nurse again in the morning.

Mature rabbits, if kept out of drafts, suffer little from low temperatures. Young litters should be provided with nest boxes and sufficient bedding to keep them warm.

PREVENTING INJURIES

Paralyzed hindquarters in rabbits are usually the result of improper handling of the animals or of injuries caused by their slipping in the hutch. Such slipping usually occurs at night when rabbits are frightened by their natural enemies, and, in an attempt to escape, dislocate vertebra, damage nerve tissue, or strain muscles or tendons. If the injury is mild, the animal may recover in a few days. It should be made comfortable, and fed a well-balanced ration. If it does not improve within a week, it should be destroyed to prevent unnecessary suffering.

PREVENTING SORE DEWLAPS

During warm weather the dewlap, or fold of skin, under the rabbit's chin may become sore. This is caused by drinking frequently from crocks and keeping the fur on the dewlap wet so long that it becomes foul and turns green. The skin on the dewlap and on the inside of the front legs becomes rough and the fur may be shed. The animal scratches the irritated area, causing abrasions and infection.

Remove the cause by placing a board or brick under the water crock so that the dewlap will not get wet when the rabbit drinks. If the skin has become infected, clip off the fur and treat the area with zinc oxide ointment or other mild disinfectant every other day until the irritation clears up.

FEEDING TO STOP FUR-EATING HABIT

Rabbits that eat their own fur, the fur of other rabbits, or that in the nest box, or the bedding material, usually do so because the ration is inadequate in quality or quantity.

The experienced breeder notes carefully the condition of each animal in the herd and regulates the quantity of feed to meet its individual requirement. Keeping good-quality hay before the rabbit at all times and feeding fresh, sound, green feed or root crops as a supplement to the grain or pelleted ration will also help to correct the abnormal appetite. Sometimes the protein content of the ration is too low. Adding more soybean, peanut, sesame, or linseed meal to the ration will correct the deficiency.

REGULAR SHEARING TO PREVENT WOOL BLOCK

In cleaning themselves, Angora rabbits lick their coats and swallow some wool. This is not digested and in the normal coated breeds about the only noticeable result is that the droppings are fastened together by fur fibers. Angora wool, however, is long and if any appreciable amount is swallowed it collects in the stomach and forms a "wool block" that interferes with digestion. If it becomes large enough, it blocks the alimentary tract and the animal starves. The most satisfactory method of preventing this is to shear regularly every 10 to 12 weeks.

GNAWING WOODEN PORTION OF HUTCH

Gnawing wood is natural for the rabbit, but the wooden parts of the hutch may be protected by placing wire mesh on the inside of the frame when constructing the hutch and by using strips of tin for protecting exposed wooden edges. Treating the wood with creosote will protect it as long as the scent and taste last. Placing twigs of trees or pieces of soft wood in the hutch protects it to some extent, as rabbits may chew these instead of the hutch.

Rabbits that have free access to good-quality hay and are receiving some fresh green feed or root crops are less likely to gnaw on their hutches.

DISPOSAL OF RABBIT MANURE

Rabbit manure has a high nitrogen content when the rabbits are fed a well-balanced ration. It will not burn lawns or plants and is easy to incorporate in the soil; hence it is satisfactory for use on gardens and lawns and about flowering plants, shrubbery, and trees.

It can be used for fertilizing soil on which crops are to be raised for feeding rabbits.

The quantity of manure produced by rabbits varies with the size of the breed, the age of the animal, and the kind of ration fed. In a year, a 10- to 12-pound doe and her 4 litters of 7 each will yield about 6 cubic feet of manure; a 10- to 12-pound herd buck or dry doe will produce 3 cubic feet. When the waste bedding from the nest box and the waste hay and straw around the rabbitry are added to the clear manure, the quantity obtained from a 10- to 12-pound doe and her 28 young will be increased to 9 cubic feet and that from a herd buck or dry doe to 5 cubic feet. The weight of rabbit manure varies greatly, depending on the quantity of moisture it contains, but a cubic foot of fresh manure weighs about 28 pounds and if thoroughly dried about 16 pounds.

The value of rabbit manure depends on how it is cared for and used. There will be less loss of fertilizing elements if the material is immediately incorporated into the soil. When manure is stored in piles and exposed to the weather, chemicals are lost through leaching and heat. Much of this loss can be prevented by wetting the manure in a compost heap or in a bin or pit. To make a compost, spread a layer, 3 to 12 inches deep, of lawn-grass cuttings, leaves, small-tree prunings, hedge trimmings, waste trimmings from garden vegetables, and weeds. Do not include diseased vegetables. Cover with a layer of rabbit manure 3 to 12 inches deep. Alternate the layers as materials become available. Tramp the compost thoroughly to exclude air, and add just enough water to make the pile moist but not enough to cause seepage. Smoking indicates the mixture is becoming heated. Thoroughly mix or stir a smoking pile with a fork, tramp it down thoroughly, and add moisture. A 3- or 4-inch layer of soil on top of the heap helps conserve the nitrogen. A small quantity of superphosphate or gypsum increases the fertilizing value, acts as a fly repellent, and counteracts odors. A cover prevents leaching.

SANITATION AND DISEASE CONTROL

To protect the herd's health, the rabbitry equipment must be kept sanitary. Remove manure, soiled bedding, and unused feed daily. Inspect water crocks and feed troughs daily. Wash them frequently in hot, soapy water; rinse in clear water; allow to drain well; and place them in the direct rays of the sun to dry. If, after washing, it is impracticable to sun the equipment properly, rinse it first in water to which a disinfectant has been added and then in clear water.

Going from hutch to hutch and washing water crocks and feed troughs with the same brush or cloth and returning them immediately to the hutches without exposure to direct sunlight or disinfection and drying is a mistake. This practice will only spread disease.

To prevent or control a disease or parasitic infection, thoroughly disinfect hutches and equipment with one of the coal-tar byproducts and allow them to dry before the rabbits are returned to them.

Nest boxes should be cleaned and disinfected before being used a second time.

Although maintaining sanitary conditions in the rabbitry is a preventive measure for controlling disease in the herd, the breeder should constantly be on the alert for the appearance of any symptom that

might be an indication of disease. Suspected cases should be isolated and held in quarantine for at least 2 weeks to determine definitely whether they are dangerous to the health of the herd. Newly acquired rabbits and those returned from shows should be placed in quarantine for at least 2 weeks before being put with the breeding herd to make sure that they are entirely free from parasites and diseases. Dead animals should be burned or buried.

Using hutches with self-cleaning floors (figs. 13 and 15) and guards on feed troughs (fig. 15) will prevent contamination of rabbits from dirty feed and aid greatly in internal parasite control.

As effective treatments are not known for very many rabbit diseases, it is usually simpler and safer to destroy a few sickly animals than to attempt to treat them and run the chance of spreading infection to healthy stock. This is especially true of animals with snuffles. For specific information on rabbit diseases write to the Bureau of Animal Industry, Washington 25, D. C.

THE RABBITRY AND ITS EQUIPMENT

The kind of buildings needed for a rabbitry depends on the location, the climate, and the money to be invested. Whatever the extent of the business, the producer should plan for construction and equipment that will facilitate handling animals properly with a minimum of manual labor. Care in feeding, breeding, and handling rabbits, as well as in cleaning hutches and keeping the house sanitary, is of utmost importance. Construction, therefore, should be as simple as possible, and ample provision should be made for light and fresh air, and for guarding against strong drafts and winds.

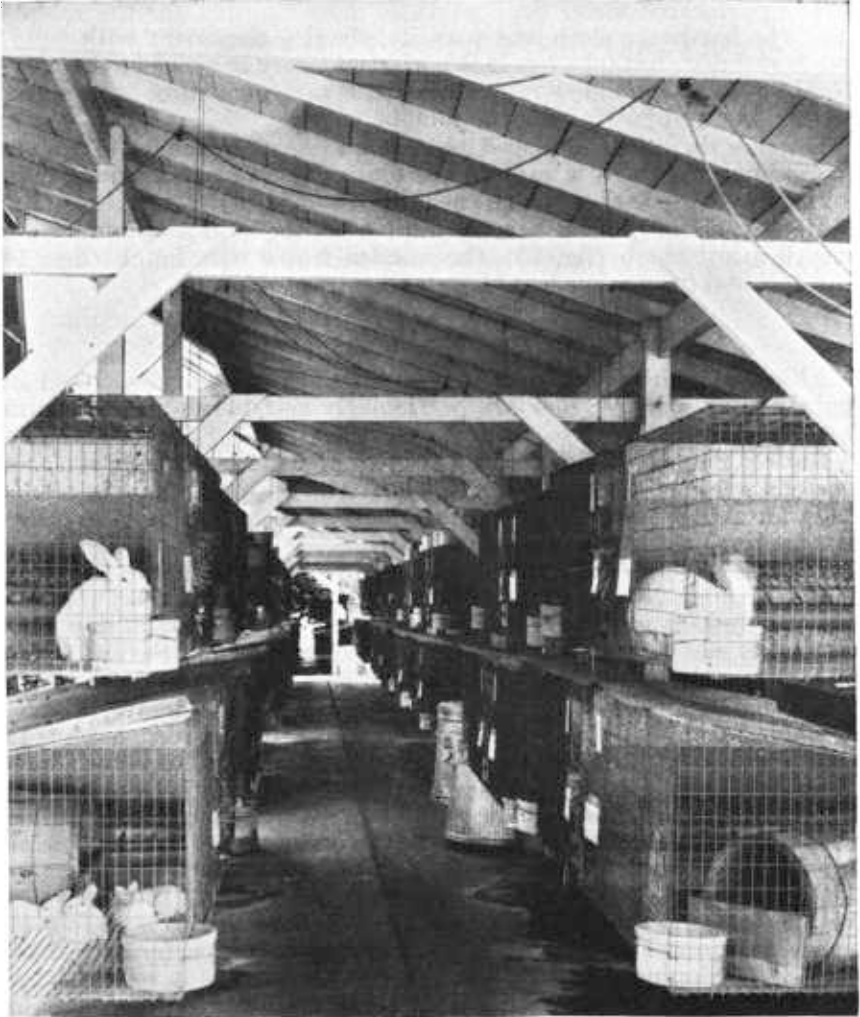
In mild climates little protection is required other than a good roof, and the sides of the hutches may be constructed either wholly or in part of wire netting. Where there is much cold weather additional protection must be provided. This may be achieved by enclosing the sides and back of each hutch with wood or with canvas curtains, or by placing the hutches in a shed or other shelter. Rabbits must also be protected against extremes of heat. This may be done by placing the hutches in the shade of trees, shrubbery, or lattices. Protection against rain, too, must be furnished; rabbits cannot stand exposure that results in thoroughly wet coats.

The rabbitry should be constructed so that natural enemies cannot kill or frighten the rabbits.

Provide individual quarters for mature rabbits. Hutches should be no more than $2\frac{1}{2}$ feet deep, so rabbits can be easily reached, and 2 feet high. The length of individual quarters should be 3 feet for small breeds, 4 feet for medium-size breeds, and 6 feet for giant breeds. These are inside measurements.

The arrangement of the hutches in single, double, or triple tiers is a problem for the individual rabbitry. Where space is not too great a factor, waist-high, single-tier hutches are preferable; they are the most convenient in observing and caring for rabbits. The two-tier arrangement utilizes space to good advantage and saves time in feeding and caring for the animals. Three-tier hutches, necessary when space is limited, are not entirely satisfactory for caring for and observing the animals in the bottom and top tiers.

Rabbits are more easily cared for and less likely to become diseased in well-built hutches than in poorly constructed, temporary ones, which become foul unless often cleaned and rebedded with straw, leaves, or other absorbent material. Self-cleaning hutches (figs. 13 and 15) need no bedding and are easily kept in good condition.



B56845

Figure 13.—All-metal hutches at the United States Rabbit Experiment Station. Feeding, watering, and cleaning are facilitated by using hutches of this type. Feed storage cans are conveniently placed.

Hutch floors may be constructed of $\frac{1}{2}$ -inch-mesh galvanized hardware cloth, 17 gage, for breeds with mature weight up to 6 pounds; $\frac{5}{8}$ inch or, if more readily available, $\frac{3}{4}$ -inch mesh galvanized hardware cloth, 17 gage, for the heavier breeds; wooden slats, varying in

width from 1 to 1½ inches and in thickness from ½ to ¾ inch, spaced ⅝ inch apart; solid boards having a slight slope toward either the front or the back; or a combination of solid boards and hardware cloth, perforated galvanized metal, or slats. The hardware cloth, perforated metal, and slat floors have the advantage of being self-cleaning.

The perforated metal floor provides more comfort for the rabbits than the hardware cloth and permits effective treatment with fumigants and disinfectants, but it is not satisfactory in areas having persistent fogs or extended rainy periods, because moisture will collect on the floor and hutch-stain the rabbits.

Hutches should be so placed as to avoid unusual excitement among the animals. Domestic rabbits are naturally quiet and enjoy being undisturbed, especially during the middle of the day.

Many types of hutches have been used, but the most satisfactory are the all-metal hutch (fig. 13), the wooden-frame wire hutch (figs. 14 and 15), and the semienclosed hutch (figs. 16 and 17).

ALL-METAL HUTCHES

All-metal hutches are satisfactory in cold climates if enclosed in tightly built shelters; they are particularly suitable in mild climates with only sheds for protection.

Domestic rabbits often become restless and gnaw exposed surfaces of wood or other readily destructible material within the hutch. This calls for repairs more or less continuously and makes the hutch unattractive, sometimes unsanitary.

The use of metal exclusively in hutch construction was formerly impracticable. Now, however, electro-spot-welded wire fabric (called muskrat fence) provides a suitable material. Anyone with mechanical ability can construct hutches from stock materials. Several types of ready-made muskrat fence rabbit hutches are on the market.

Convenient, two-compartment hutches, as shown in figure 13, may be made of electro spot-welded wire fabric, 1- by 2-inch mesh. If rats or other natural enemies are likely to cause trouble, 1- by 1-inch mesh should be used. This material in 24-inch widths can be used for the sides and ends. Labor may be saved by using one length of wire fabric for all sides, bending it at the corners; but separate pieces cut for front, back, and sides can be fastened together at the corners with spiral wire or soft galvanized stovepipe wire of about 12 gage. In the same way, the sides and ends can be attached to a bottom of either galvanized ⅝-inch mesh hardware cloth or perforated metal sheets. If sloping roofs are used on the hutches, as is required for lower sections in tier installation, the sheet metal for the roofs should be enough longer than the hutches to permit a 2-inch flange on each end. These flanges provide additional rigidity. The top can be made of either electro spot-welded wire fabric or galvanized sheet iron. The hay manger between the compartments can be constructed of 1-inch mesh, 16-gage poultry netting. The electro spot-welded wire fabric can be cut as desired to provide openings for doors, feed troughs, and hay mangers.

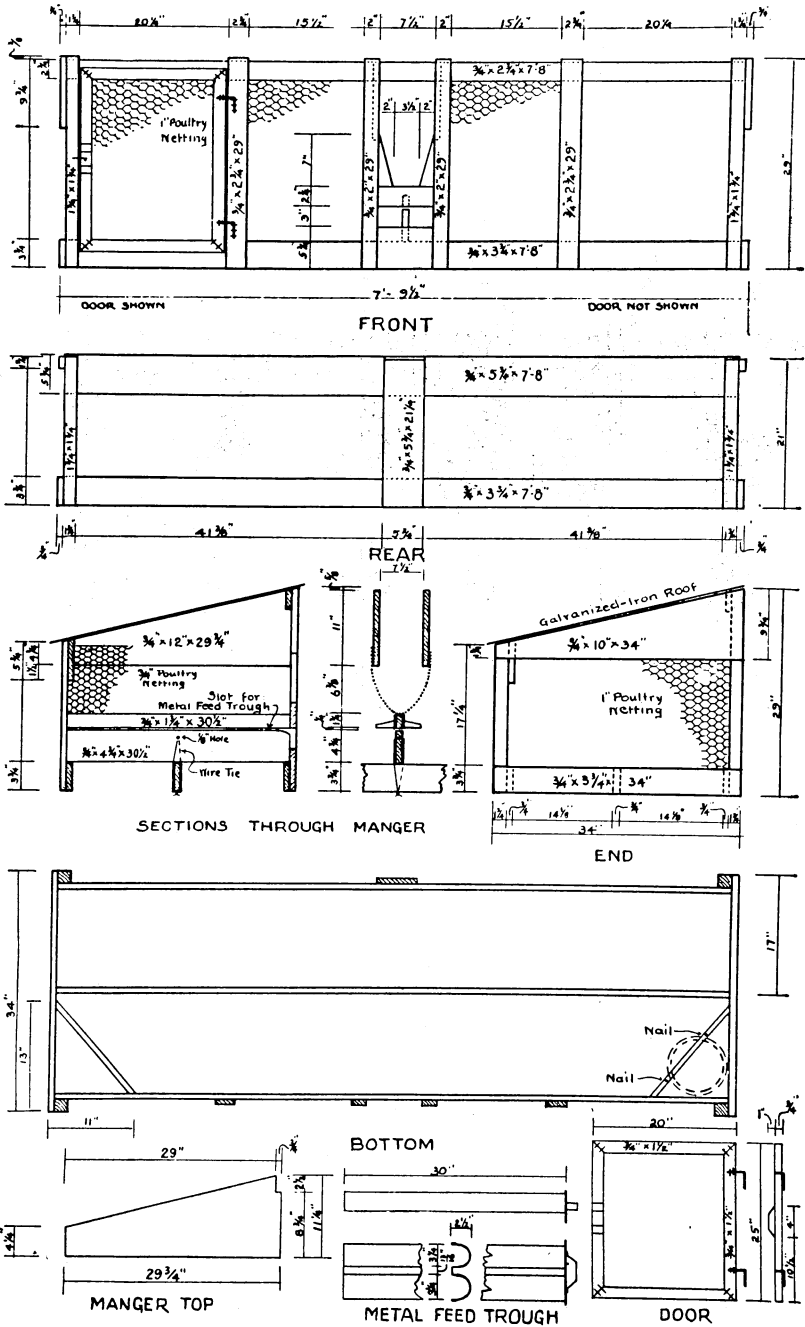


Figure 14.—Construction details for a two-unit wooden-frame wire hutch.

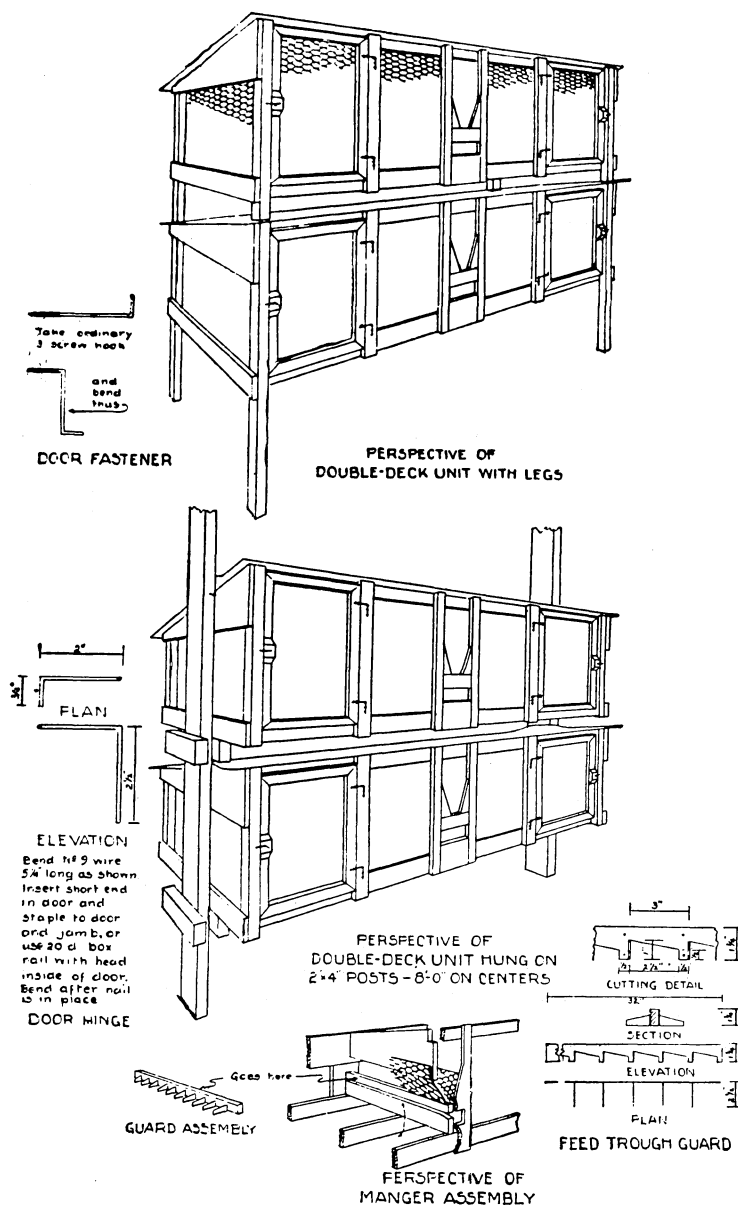


Figure 15.—Additional construction details for a two-unit wooden-frame wire hutch, including manner of hanging two tiers of hutches.



Figure 16.—Outdoor hutches for Central States.



Figure 17.—Outdoor hutches for Rocky Mountain States.

WOODEN-FRAME WIRE HUTCHES

Though not so durable as the all-metal hutch, the wooden hutch with woven-wire sides and ends permits good circulation of air and is more sanitary than a solid hutch. It can be constructed as shown in figures 14 and 15 of the following materials:

Bill of Materials for Wooden-frame Wire Hutch

Lumber (all sizes net for S4S material) :

- 2 pieces, $1\frac{3}{4}$ by $1\frac{3}{4}$ by 29 inches—for front corner posts. (If legs are desired the pieces should be 60 inches long for a single-deck unit and 76 inches long for a double-deck unit.)
- 2 pieces, $\frac{3}{4}$ by $2\frac{3}{4}$ by 29 inches—for door jambs.
- 2 pieces, $\frac{3}{4}$ by 2 by 29 inches—for manger front.
- 2 pieces, $\frac{3}{4}$ by 2 by 7 inches—for triangular manger front.
- 1 piece, $\frac{3}{4}$ by $5\frac{3}{4}$ by $7\frac{1}{2}$ inches—for manger front.
- 1 piece, $\frac{3}{4}$ by $2\frac{3}{4}$ by $7\frac{1}{2}$ inches—for manger front.
- 2 pieces, $1\frac{3}{4}$ by $1\frac{3}{4}$ by 21 inches—for rear corner posts. (If legs are desired, the pieces should be 52 inches long for a single-deck unit and 68 inches long for a double-deck unit.)
- 1 piece, $\frac{3}{4}$ by $5\frac{3}{4}$ by 21 inches—for manger rear.
- 1 piece, $\frac{3}{4}$ by $2\frac{3}{4}$ inches by 7 feet 8 inches—for top front.
- 1 piece, $\frac{3}{4}$ by $5\frac{3}{4}$ inches by 7 feet 8 inches—for top rear.
- 3 pieces, $\frac{3}{4}$ by $3\frac{3}{4}$ inches by 7 feet 8 inches—for bottom.
- 2 pieces, $\frac{3}{4}$ by $1\frac{3}{4}$ by $9\frac{3}{4}$ by 34 inches—for top ends.
- 2 pieces, $\frac{3}{4}$ by $3\frac{3}{4}$ by 34 inches—for bottom ends.
- 2 pieces, $\frac{3}{4}$ by $2\frac{3}{4}$ by 17 inches—for crock supports.
- 2 pieces, $\frac{3}{4}$ by $4\frac{1}{4}$ by $11\frac{1}{4}$ by $29\frac{3}{4}$ inches—for manger top.
- 1 piece, $\frac{3}{4}$ by $1\frac{3}{4}$ by $30\frac{1}{2}$ inches—for manger bottom.
- 1 piece, $\frac{3}{4}$ by $4\frac{1}{4}$ by $30\frac{1}{2}$ inches—for feed-trough track.
- 4 pieces, $\frac{3}{4}$ by $1\frac{1}{2}$ by 25 inches—for vertical doors.
- 4 pieces, $\frac{3}{4}$ by $1\frac{1}{2}$ by 20 inches—for horizontal doors.
- 2 pieces, 1 by $1\frac{1}{2}$ by 4 inches—for door-latch blocks.

Galvanized iron:

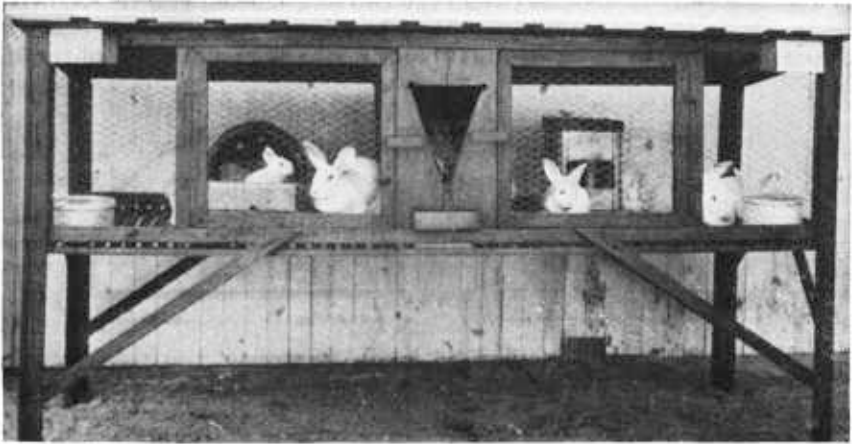
- 2 pieces, 24 gage, $1\frac{3}{4}$ by 30 inches—for feed-trough guards.
- 1 piece, 26 gage, 36 inches by 8 feet—for roof.

Miscellaneous:

- 1 piece, $\frac{5}{8}$ -inch mesh, 17-gage galvanized hardware cloth, 30 inches by 8 feet—for floor.
- 1 piece, $\frac{3}{4}$ -inch mesh, 16-gage poultry netting, 24 by 36 inches—for manger.
- 1 piece, 1-inch mesh, 18-gage poultry netting, 24 inches by 8 feet—for front and doors.
- 1 piece, 1-inch mesh, 18-gage poultry netting, 18 inches by 14 feet—for back and ends.
- 4 hinges.
- 2 door latches.
- Fourpenny box nails—for front, rear, and roof.
- Eightpenny box nails—for posts, ends, and bottom.
- Poultry-netting staples.

These hutches are designed to fit between 2- by 4-inch supports set flatwise and 8 feet apart from center to center. If 4- by 4-inch posts are used, the hutches must be 2 inches shorter or the post spacing 2 inches wider.

Another satisfactory type of hutch, which is light-weight, portable, and inexpensive, is shown in figure 18. Hutches of this kind have proved popular when building materials were scarce. It may be placed under trees or on the protected side of a shed or building. The floor may be of $\frac{5}{8}$ -inch-mesh hardware cloth instead of the narrow wooden slats shown; either floor allows the manure to fall through to the ground. Owners raising small numbers of rabbits in the back-yard may prefer this hutch, if there is no danger from dogs. It is especially suitable for 4-H Club projects.



B61900

Figure 18.—An economical hutch of light construction, which can be moved from place to place.

Rabbits kept in hutches made of wooden frames and wire require additional protection in cold climates.

SEMIENCLOSED HUTCHES

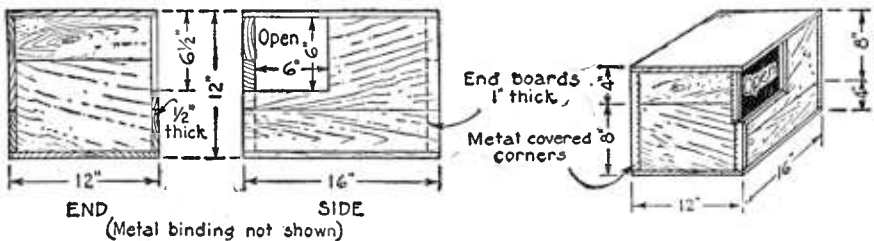
The semienclosed hutch is constructed with ends and back of wood. An extending roof gives added protection. This hutch is used in outdoor rabbitries in colder climates (figs. 16 and 17).

HAY MANGERS AND FEED TROUGHS

Hay mangers and feed troughs should be big enough to prevent waste of feed and save time in feeding. A convenient type of hay manger with a trough that prevents waste of hay is shown in figure 14. Feed troughs should be removable, so they can be readily cleaned and disinfected. Feed guards should be placed on feed troughs at 3-inch intervals to keep young rabbits from getting into the trough and contaminating the feed. Feed guards also aid materially in preventing the scratching out and wasting of feed.

NEST BOXES

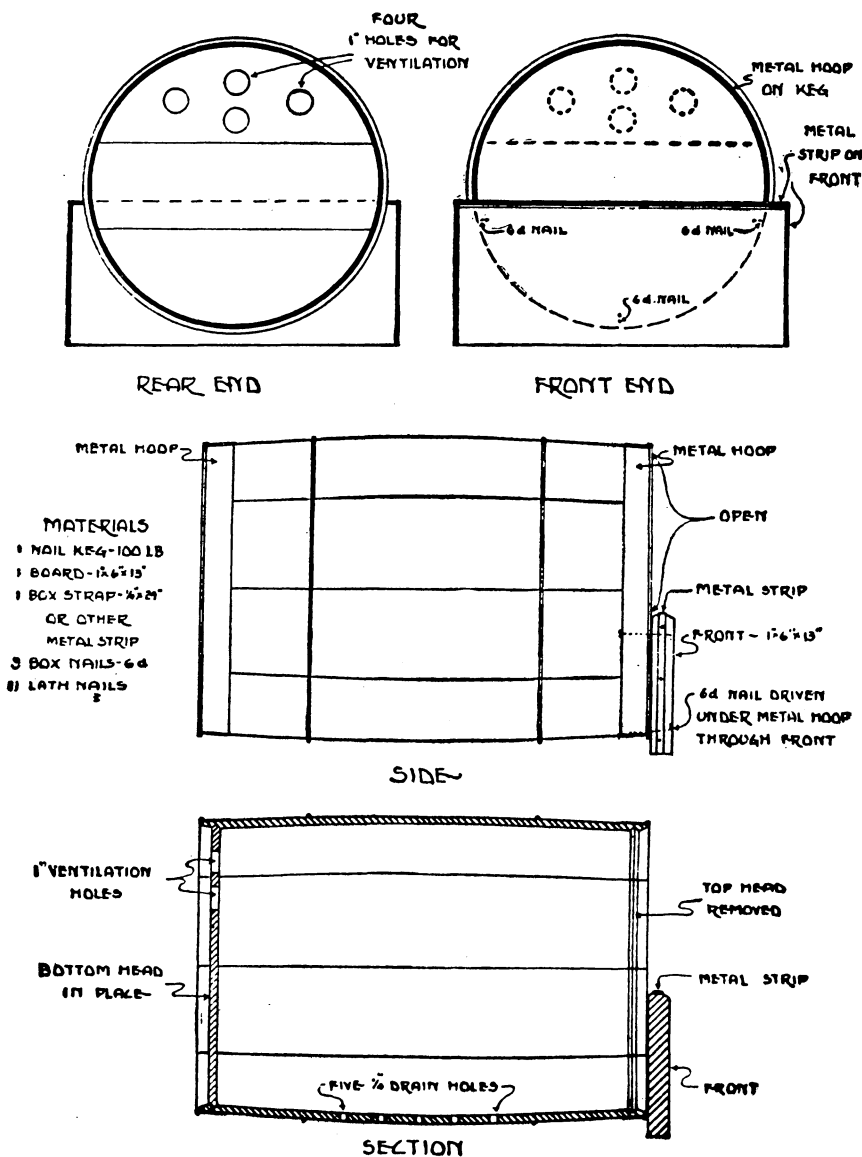
Nest boxes should be large enough to prevent crowding but small enough to keep the occupants warm by their own body heat. Two general kinds of nest boxes are used extensively—the box type (fig. 19) and the nail-keg type (fig. 20).



B-4346-M

Figure 19.—Construction details for nest box.

The box type is constructed so the top and bottom can be removed to facilitate cleaning. The nail-keg box is inexpensive and easy to construct. A nail keg with metal end hoops is best for the purpose.



B-8742-M

Figure 20.—Construction details for nail-keg nest box.

One with a head diameter of 13 inches is preferable for does weighing more than 12 pounds; 11 1/2 inches for those weighing 8 to 12 pounds; and 10 inches for those weighing less than 8 pounds.

Losses of young rabbits kindled in winter can be largely prevented by furnishing proper nesting accommodations. The type of nest box used during the warmer months or in the Southern States must be modified if losses from freezing are to be reduced to the minimum.

If a doe reacts normally to her newborn litter by pulling enough wool to make a warm nest and feeding her young, and the nest box is well insulated, the young can survive temperatures as low as 15 to 20 degrees below zero.

A good type of winter nest box can be made by placing a standard-size nest box (fig. 19) inside a larger box, so that a space of 3 inches on all sides, except entrance and top, can be packed with straw or other insulating materials.

A lid of ordinary box wood covered on the under side with two thicknesses of corrugated cardboard will supply the necessary top insulation. Two or three holes, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, should be made in the end of this lid farthest from the opening to the nest box, for ventilation and to prevent moisture condensation within the nest box.

On the bottom of the inner box one or two layers of corrugated cardboard will keep the newborn litter from coming in contact with the cold boards.

The nest box should then be filled so completely with new clean straw that the doe will have to burrow into it to form her nest cavity.

Daily inspections for the first 3 or 4 days are desirable. If enough moisture has accumulated to make the cardboard damp, it should be promptly removed or replaced with another if cold weather continues.

A simpler nest box for use in winter consists of a single box lined completely with one or two layers of corrugated cardboard and filled with straw.

Bedding Material for Nest Boxes

Bedding material for the nest box should be absorbent and of the type that the doe can mix with the fur she pulls from her body. In cold weather, when deep nests are necessary, straw is the best material. For the warm season, straw, hay, leaves, cottonseed hulls, etc., may be supplied in the proper quantities to make a shallow nest. If does are being fed a ration consisting of pellets only, they are likely to eat any palatable material used for bedding. In warm areas, soft, wooden shavings that are unpalatable can be mixed with fur to make a shallow nest.

SELF-FEEDERS

A self-feeder, with a separate compartment for each kind of grain or pellet, is a desirable piece of equipment for animals that are to be full-fed. The self-feeding system is primarily adapted to feeding pregnant does, does with nursing litters, and rabbits raised for the meat market. It is not recommended for dry does or herd bucks, or for developing breeding stock. Full-feeding these rabbits would make them too fat for breeding.

The self-feeder is not adapted for use with a mixed ration that can be separated by rabbits, as the animals in search of the more palatable kinds of feed will scratch out and waste the mixture. On the other hand, when different grains and protein supplements are placed in

separate compartments, providing free access to them at all times, the rabbits will consume the particular feed they like and the quantity wasted will be negligible.

Does that have access to a self-feeder should be carefully watched the first few days after kindling. If the size of the litter is materially reduced for any reason, or if the doe produces more milk than the young will consume, it may be necessary to transfer young from another litter or to restrict her diet for a few days to check the heavy milk secretion and avoid udder complications.

Self-feeding saves labor and feed, and makes possible a consistently high-quality market product. Self-fed rabbits gain more rapidly than hand-fed rabbits.

FEED HOPPERS

A feed hopper is used to feed only one kind of feed—not a mixed feed. A self-feeder with compartments is best when more than one kind of grain or pellets are fed.

An inexpensive feed hopper that will hold about 15 pounds of pellets or grain may be made from a common square 5-gallon can (fig. 21). First, cut off the top. Then cut holes on two opposite sides. The holes should be 4 inches high, 4 inches from the bottom, and 1 inch from each side after the rough edges have been bent inward to give a smooth edge all around, and to add rigidity. Take a 1- by 4-inch board, 13½ inches long, and cut it diagonally into two equal triangular pieces. These serve as supports to the baffle boards, which are nailed to them. The baffle boards, of ¼-inch, 3-ply lumber, should extend 1 inch below the bottom of the side openings of the can. It is essential that the baffle boards fit snugly against the sides of the can so feed cannot slip by. The space between the lower ends of the baffle boards permits the grain or pellets to flow down as the rabbits eat. Round the top corners of the baffles so that each baffle will rest against the top edge of the can. Cover, with tin, the edges of exposed boards that rabbits can gnaw. Put a finishing nail in the outer edge of the triangular piece supporting the baffle (fig. 21, *B*), and bend the nail to hook over the lower lip of the opening to hold it and the baffle in place. A piece of 11-gage galvanized wire with one end formed into an eye and the other into a hook can be fitted tightly around the can to prevent bulging (fig. 21, *A*).

Hutch floor space can be saved by using a hopper with a single feed opening and placing the hopper only part way into the hutch. Cut an opening large enough to accommodate the hopper in the side of the hutch. Then wire the top of the hopper to the hutch for support. One short baffle on the side opposite the opening will keep feed out of corners.

The feed hopper (fig. 21, *A*) can be made into either a two- or a four-compartment self-feeder by inserting partitions. Drive four small staples into each baffle board, two on each side of center, so placed as to serve as guides to the center partition (fig. 21, *B*). Nail narrow pieces of lumber to the edges of the triangular supports below the baffle boards to build them up flush with the surfaces of the baffle boards. This will keep feeds in the compartments from intermixing.

For a two-compartment self-feeder, only the wedge-shaped partition (fig. 21, *D*) is inserted. When this partition only is used, a 1-inch

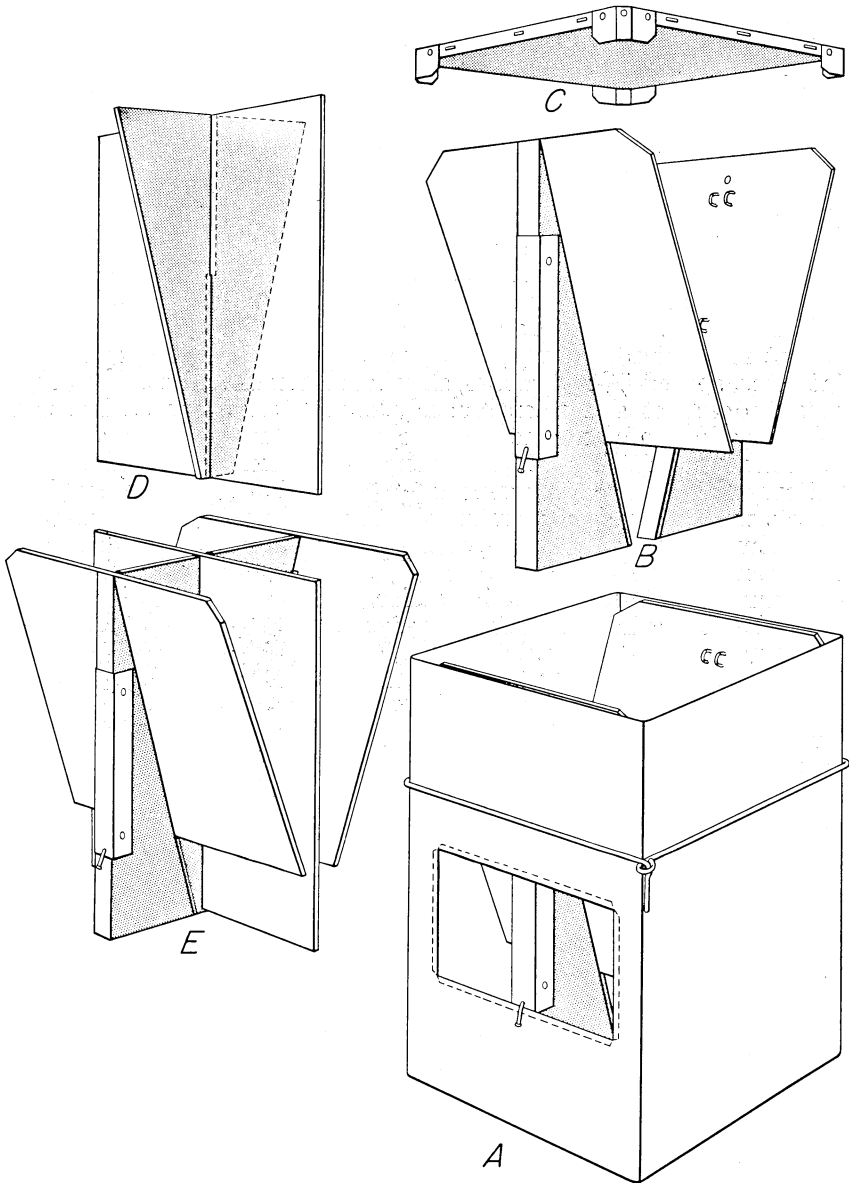


Figure 21.—A feeder made from a 5-gallon can. *A*, Feed hopper for one kind of feed. *B*, The two baffles withdrawn from the feed hopper. *C*, Lid. *D*, Double partition to fit between baffles of feed hopper to make it into self-feeder that will hold four feeds, one in each compartment. *E*, Assembled units (*B* and *D*) to insert in can to complete self-feeder.

strip of metal may be folded and placed over the narrow opening in the upper part of the partition to prevent intermixing of feed.

The two-compartment self-feeder can be made into a four-compartment one by inserting the other grooved partition at right

angles to the one already in place (fig. 21, *E*). Having four separate compartments, each containing a different grain or pelleted protein supplement, prevents waste which would otherwise result as the animals scratch in search of the more palatable feeds.

A suitable lid (fig. 21, *C*) is made of lumber, with projecting metal strips at each corner.

SHELTERS FOR HUTCHES

In areas where the climate is mild, hutches may not require any protection. In some localities rabbits must be protected from strong winds, rain, and snow; in others, from excessive sunlight. The type of shelter should be determined by local conditions. In southern California and areas with a similar climate, a lath superstructure is all that is required, largely as a protection against excessive heat. The laths, spaced $\frac{5}{8}$ inch apart, should run north and south so that the sun does not shine continuously on the same spot. In other regions, solid roofs are necessary to protect hutches from driving rain and snow; in still others, additional protection, such as adjustable shutters or canvas sides, is essential.

Posts supporting the superstructure should be spaced so as to permit the hutches to rest on them, or the hutches may be suspended from cross beams above.

Concrete floors make sanitation easier. They should slope properly to permit easy cleaning and drainage.

COMMERCIAL PRODUCTION

Rabbits are raised commercially for meat, fur, and wool. As the pelts are a byproduct of meat production, animals are usually marketed when they reach fryer weight, even though the pelts are not prime. Usually it does not pay to hold the animal until the pelt is prime.

The quantity of feed required to produce a pound of marketable rabbit varies with age of the animal, ration, and method of feeding.

The types of hutches and equipment for feeding and watering, of course, have a direct bearing on the amount of labor involved in raising rabbits. Estimates have shown that approximately 10 man-hours are required each year to care for each doe.

FRYER PRODUCTION

Fryer rabbits weigh from 4 to $4\frac{3}{4}$ pounds when weaned at 2 months. They are ready for market and will yield a carcass (including liver and heart) of 50 to 59 percent of the live weight, 78 to 80 percent of which is edible. In recent years, the tendency of buyers has been to favor heavier carcasses. For fryer production, medium to heavy-weight breeds are preferred, owing to their ability to develop to the desired weight and finish by the time they are 2 months of age. Skins of white breeds bring higher prices.

The number retained in the litter should be adjusted to six, seven, or eight young, depending on the capacity of the doe to nurse them. For heavy producing strains, nine young may be retained. A pound of marketable fryer rabbit will require $3\frac{1}{2}$ to $4\frac{1}{2}$ pounds of total ration, from mating of the doe to marketing of the young at 2 months of age. Excellent mother does nurse their litters for 6 to 8 weeks.

Because young that are weaned and held for several days before marketing may fail to gain or actually lose weight, they should be left with their mothers until they go to market. If it is desirable to produce fryers heavier than those weaned at 56 days of age, young rabbits may be kept with their mother for an additional 8 or 9 days. These fryers should gain an average of $\frac{1}{10}$ pound during this period. They will require $5\frac{1}{4}$ pounds of feed per pound of increase in live weight. To make these gains, rabbits have to be full-fed a well-balanced ration. For maximum production per doe, animals must be properly handled. Returns will be greater if labor-saving equipment is used.

ROASTER PRODUCTION

Rabbits culled from the breeding herd either early or at the end of their period of usefulness may be used as roasters, provided they are in proper condition. Ordinarily, those that are culled early from the breeding stock require little fattening to prepare them for market. Does and bucks that have passed their periods of usefulness may carry enough flesh to make fattening them for slaughter profitable. In some areas it may also pay to develop young rabbits to the heavier weights primarily for the meat market. Such rabbits should yield a carcass 55 to 65 percent of the live weight, of which 87 to 90 percent is edible.

The quantity of feed required to produce a pound, live weight, increases with each pound of gain. If full-fed, about $5\frac{1}{2}$ pounds of feed are required for increasing the live weight from 4 to 5 pounds; 6 pounds for increasing from 5 to 6 pounds; $6\frac{1}{2}$ pounds for increasing from 6 to 7 pounds; 7 pounds for increasing from 7 to 8 pounds; $8\frac{1}{2}$ pounds for increasing from 8 to 9 pounds; and $10\frac{1}{4}$ pounds for increasing from 9 to 10 pounds. Does require 8.6 percent less feed than bucks and 3 percent less feed than castrated bucks to gain a pound in live weight.

Castrating bucks shortens the period required to attain a given live weight and saves about 5 percent of feed required to produce a unit of gain. If a buck is castrated at 2 months of age, his skin on maturity will grade as a doe skin and sell for a higher price than a buck skin. These factors usually do not justify castration. However, one advantage from the operation is that a number of animals can be kept together with a consequent saving in equipment, time, and labor.

In self-fed or hopper-fed rabbits weighing 4 to 12 pounds, live weight, the poorest skins come from 7- to 9-pound animals up to 134 days of age. Older animals produce a higher percentage of better-grade skins.⁴

Whether or not it will pay to grow or condition heavier rabbits for market depends on the relative cost of feed and market value of the finished product.

ANGORA RABBIT WOOL PRODUCTION

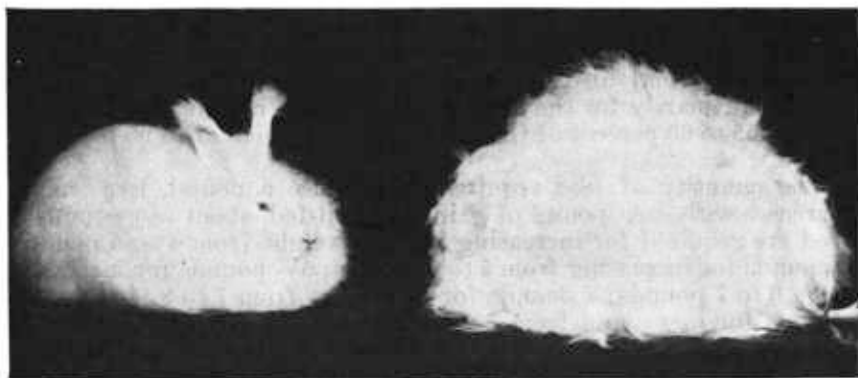
Angora raising for wool is a comparatively new phase of the rabbit industry. On Angoras, wool grows 5 to 8 inches a year and, under the

⁴ Further information is contained in Circular 789, Effect of Various Factors on Grades of New Zealand White Rabbitskins, issued by the U. S. Department of Agriculture.

commercial practice of shearing four times a year, it reaches a length of $2\frac{1}{2}$ to $3\frac{1}{2}$ inches each quarter; from a mature animal (fig. 22) not nursing young, about 14 ounces of wool a year may be sheared. This wool is valued for its softness, warmth, and strength, and may be dyed delicate pastel colors. It is used in the manufacture of children's clothing, sport clothes, garment trimmings, and clothes for general wear.

Inexperienced persons who are interested in raising Angora rabbits should study the business thoroughly, begin in a small way with three or four does and a buck, and increase the herd only as experience and market for the product dictate.

There are two types of Angora rabbits—the English and the French—but it is difficult to distinguish one from the other when they are off type. Choice is largely a matter of personal preference. The typical French Angora is usually larger than the English; the wool fiber of the English is longer and finer than that of the French.



A11325

Figure 22.—An Angora rabbit and the clippings from another rabbit.

Angoras are fed and cared for by the same methods as other breeds. Because of wool covering, it is necessary to handle Angoras to determine how much flesh they are carrying. This may be determined by the condition of flesh along the backbone. The quantity of feed may be reduced or increased to keep animals in condition.

A properly constructed manger for hay and green feed protects the wool from foreign matter and prevents contamination of feed.

Herd bucks and does should be kept in individual hutches. Woolers—does and castrated bucks maintained primarily for wool production—may be kept in groups or colonies to save labor.

To prevent infestation with internal parasites and to keep the wool clean, the pens should have self-cleaning floors.

To prevent fighting among rabbits, bucks that are to be reserved for woolers should be castrated when weaned (at 2 months of age) or shortly thereafter.

Equipment for Grooming and Shearing

Equipment necessary for grooming and shearing includes:

A table, waist high, with a 12- by 24-inch top covered with carpet or feed sack, to keep the rabbit from slipping, and equipped with castors to allow easy turning.

A brush, sold as a hairbrush, with single steel bristles set in rubber, for brushing and removing foreign material from wool.

A pair of sharp barber's scissors.

A ruler for measuring the length of wool.

Containers for storing wool.

Grooming

Commercial woolers require little, if any, grooming between shearings, provided they are properly cared for and shearing is done every 10 to 12 weeks. If the coat is allowed to grow for a longer period, the fibers are likely to become webbed or slightly tangled, or to form mats.

For grooming, place the rabbit on the table, part the wool down the middle of the back, and brush one side, making strokes downward and, as the end of the wool is reached, upward and outward to remove all foreign material. Make another part in the wool about half an inch farther down the side and repeat the operation until the job is completed. Groom the other side in like manner.

For grooming the head, front legs, and belly, place the rabbit on its back in the lap, with the hindquarters held gently but firmly between the knees. Separate small areas of wool and groom as for the sides.

For grooming the hind legs, place the rabbit on its back in the lap with the head and front feet under the left arm. Use the left hand to hold the rabbit's hind legs. Cut off all stained ends of wool before shearing.

Shearing

Young rabbits are sheared or plucked at 8 weeks of age and every 10 to 12 weeks thereafter. Rabbits should be handled gently and quietly.

Place the back of the scissors against the rabbit's body to prevent cutting of the skin. Beginning at the rump, shear a strip about half an inch wide to the neck. Repeat this operation until all the wool is removed from one side. Then turn the rabbit around and repeat the shearing operation on the other side, starting at the neck and shearing toward the rump.

For shearing the head, front legs, belly, and hind legs, the rabbit should be restrained as for grooming, care being taken to avoid injuring the doe's teats. Wool should not be sheared from the belly of a pregnant doe.

After shearing, give the rabbit a light brushing to straighten out fibers and prevent the formation of mats.

During cold weather newly sheared rabbits need protection. A nest box in the hutch affords adequate protection during cool spells but when the temperature is as low as 30° to 40° F., it is necessary to keep the animal in a building where comfortable temperatures can be maintained. In winter, half an inch of wool left on the body aids in protecting the rabbit.

Grading, Preparing, and Marketing Wool

A container for each grade of wool should be labeled and placed near the shearing table. The wool may be graded as sheared. Following are the usual commercial grades:

Plucked No. 1.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, 3 inches or longer.

Plucked No. 2.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, 2 to 3 inches.

Super Wool Cut.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, $3\frac{1}{4}$ inches and over.

No. 1.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, $2\frac{1}{4}$ to 3 inches.

No. 2.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, $1\frac{1}{2}$ to 2 inches.

No. 3.—Pure white, absolutely clean, free of all mats and foreign matter; staple length, 1 to $1\frac{1}{2}$ inches.

Shorts.—Pure white and absolutely clean, but may be slightly webbed.

No. 4.—Pure white, clean, matted.

No. 5.—Stained and unclean wool, matted or unmatted.

Put each grade in a separate paper bag. The wool from 8-week-old rabbits should be put in a separate bag. One about 12 inches high will hold a pound without packing too tightly. Tie the bags and place them in burlap sacks or corrugated boxes for shipment.

If the wool is to be stored, put mothballs or crystals in cloth sacks with it in tightly covered containers.

Some Angora breeders spin the wool on an old-fashioned spinning wheel and knit the yarn into garments for home use or for sale. Others market wool to organizations or individuals in a position to collect quantities large enough to sell to mills.

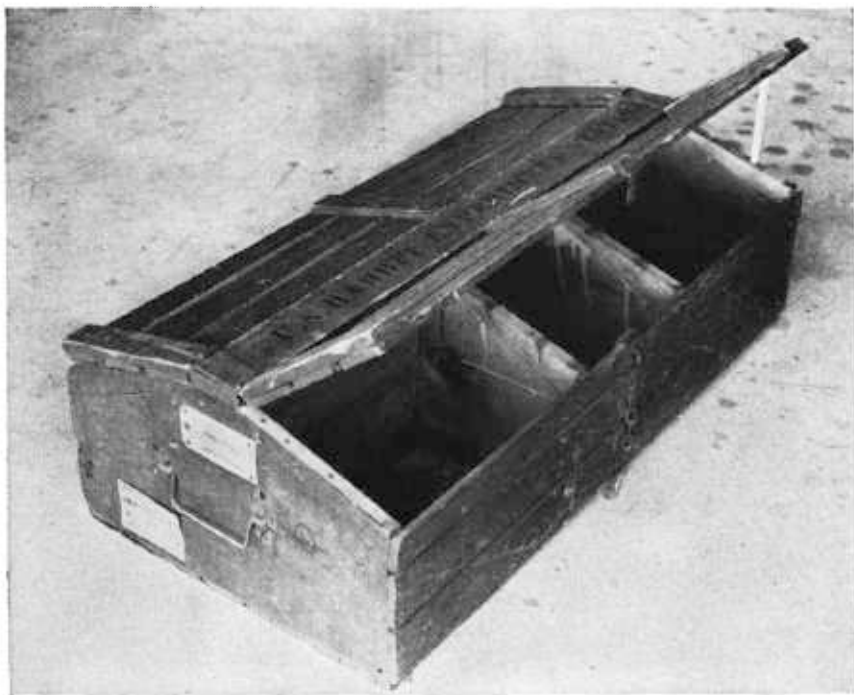
PREPARING PRODUCTS FOR MARKET

CRATING AND SHIPPING LIVE RABBITS

Rabbits in good condition, properly crated and provided with food and water, can be shipped almost any distance with safety, but it is best not to ship them in extremely hot or cold weather. Crates should always be comfortable, well ventilated, and furnished with bedding of straw or leaves, not sawdust. Slanting tops prevent stacking of boxes on top of the crates. Only one animal should be placed in one compartment of a shipping crate. Animals to be in transit for 24 hours or less need no more attention than that required to supply a small quantity of feed and water at the beginning of the journey. If the trip is long and the shipment large, more feed and water will, of course, be needed and it may be necessary to send along a caretaker. Plenty of fresh water and hay should be accessible to the rabbits at all times. The same kinds of feed that they have been accustomed to eating in the rabbitry should be given them in transit.

Although shipping crates can be made from packing boxes, it is not only good business but effective advertising to ship rabbits in durable crates that are neatly built, light in weight, and attractive (fig. 23). The shipper should furnish ample space in each compartment and see to it that wire netting effectively keeps the rabbits from gnawing the wood.

When rabbits are shipped by express, a bag of feed and a printed request to feed and water the animals once daily should be attached to each crate. Advice should be given against exposing the animals to sun or rain and also against placing the crates near steam pipes. The purchaser should be notified when rabbits are shipped.



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Figure 23.—Crate for shipping live rabbits.

No permit is required for importing domestic rabbits, but there is a 15-percent duty, details of which may be obtained from the Bureau of Customs.

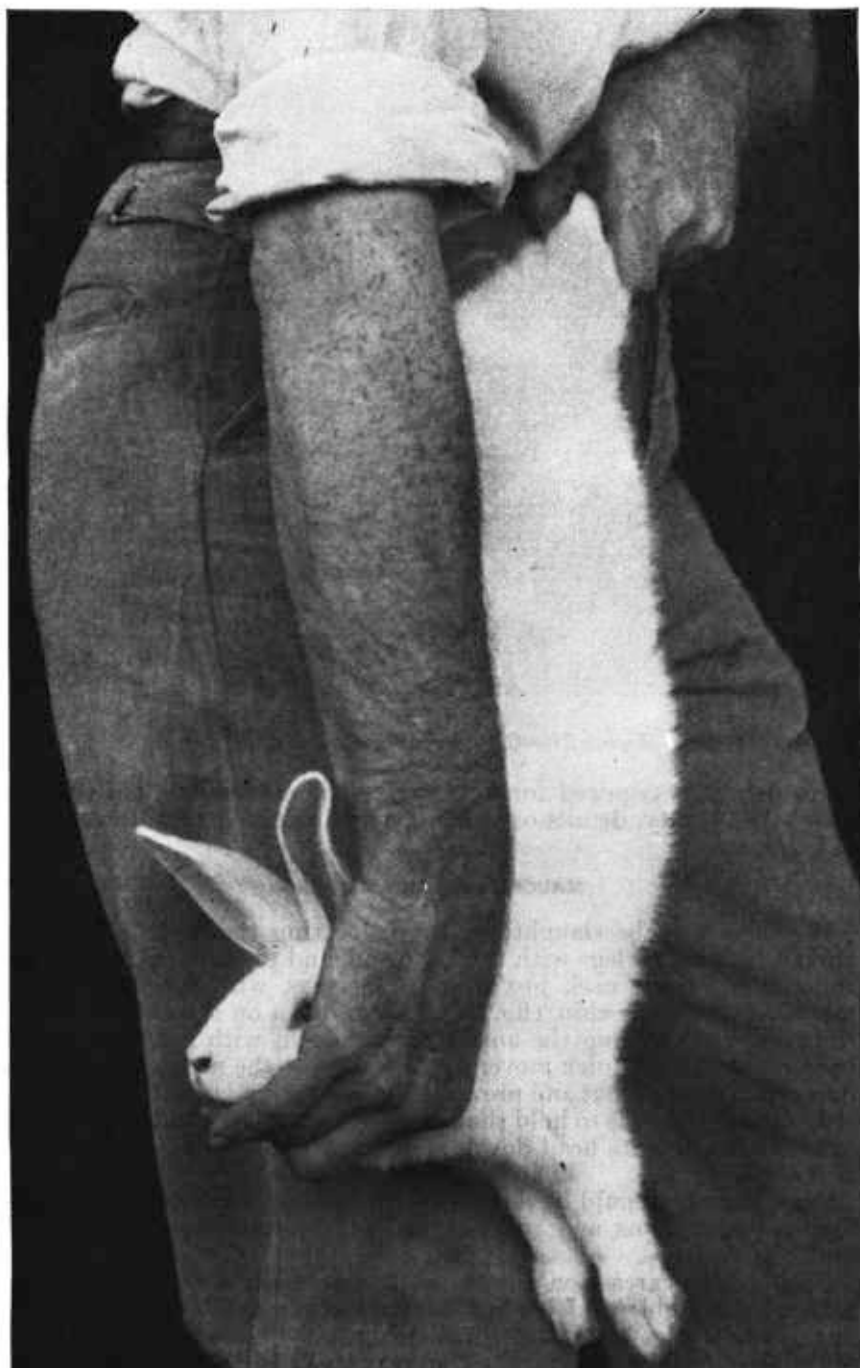
SLAUGHTERING AND SKINNING

A rabbit may be slaughtered by dislocating the neck. Hold the animal by its hind legs with the left hand, and place the thumb of the right hand on the neck just back of the ears, with the four fingers extended under the chin (fig. 24). Push down on the neck with the right hand, stretching the animal; press down with the thumb, and raise its head by a quick movement to dislocate the neck. This makes the animal unconscious and prevents struggling.

Another method is to hold the animal with the left hand at the small of the back, with its head down, and stun it by a heavy blow at base of the skull.

Slaughtering should be done in clean sanitary quarters. Information on regulations and restrictions should be obtained from local health authorities.

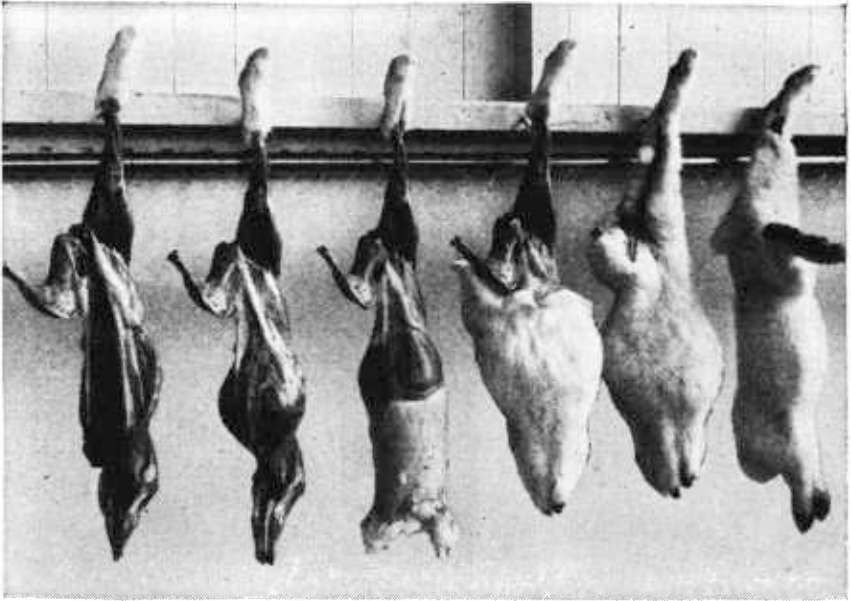
Suspend the carcass on a hook inserted between the tendon and the bone of the right hind leg just above the hock. Remove the head immediately to permit thorough bleeding so the meat will have a good color. Remove the tail and the free rear leg at the hock joint, and cut off the front feet. Then cut the skin just below the hock of the suspended leg and open it on the inside of the leg to the root of the tail,



B56848

Figure 24.—How to hold rabbit for dislocating neck in slaughtering.

continuing the incision to the hock of the left leg. Carefully separate the edges of the skin from the carcass, taking special pains to leave all fat on the carcass as the skin is pulled down over the animal. This not only makes a more attractive meat product but facilitates drying the skin and prevents "fat burns" on the pelt in drying (fig. 25). When a skin is left entire it is known as a cased skin. Even small cuts lessen the value of a skin. As soon as the skin is removed, it should be placed on a stretcher, secured, and hung up for drying (fig. 26).

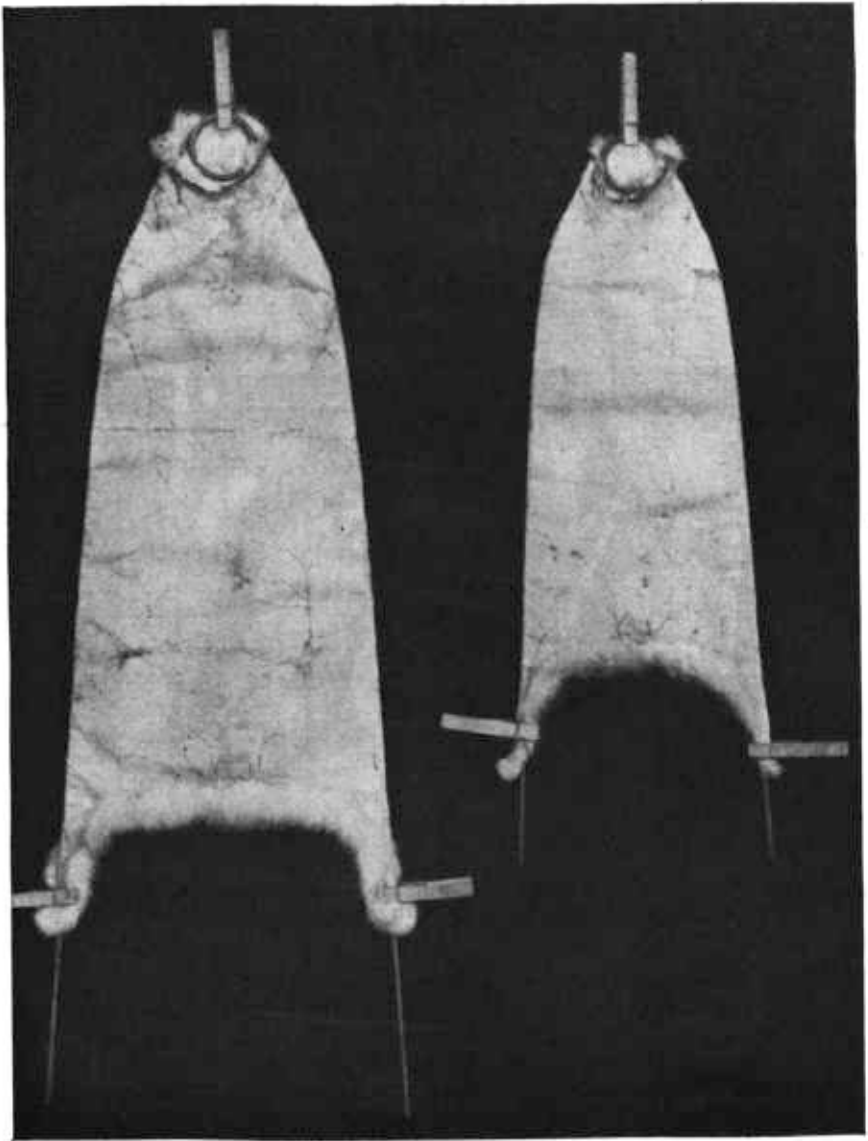


B56847

Figure 25.—Steps (right to left) in skinning rabbits and removing internal organs. Small jets of water from pipe beneath rack wash blood from back panel and trough.

After the carcass has been skinned, make a slit along the median line of the belly, and remove the entrails, leaving the liver in place. Remove the right hind foot by severing at the hock. Take particular care not to get hairs on the carcass; they are difficult to remove and detract from the appearance. Rinsing the carcass in cold water facilitates removal of hair and blood and also cleanses the carcass. Brush the rabbit's neck thoroughly in water to remove the blood. It is not good practice to leave the carcass in water more than 15 minutes; prolonged soaking causes it to absorb water, and water in the meat is considered adulteration. Soaking rabbit meat gives it a blanched color, but this does not make it more desirable.

Hanging by the hind legs for chilling may cause a carcass to be drawn out of shape, so that the pieces will not fit satisfactorily into a carton. Some processors chill carcasses in wire trays, arranging them so the pieces will be of a proper shape for packaging. Carcasses should be chilled overnight before being cut up.



B56849

Figure 26.—How to place a rabbit pelt on a shaper, or stretcher, with all the legs on the same side.

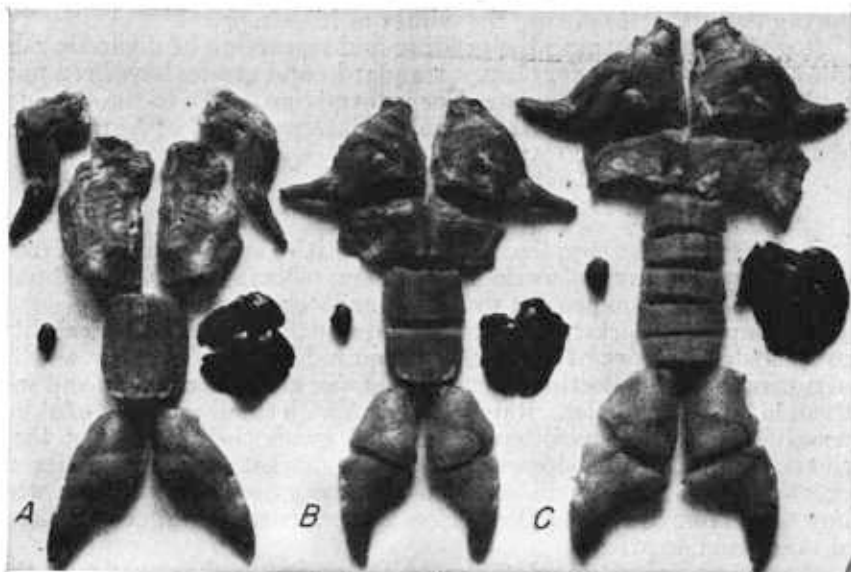
DISPLAYING, CUTTING UP, AND PACKAGING RABBIT MEAT

Domestic rabbit meat should be offered for sale neatly dressed. The carcass should be skinned and eviscerated, and have head and feet removed. The heart, kidneys, and especially the liver are palatable and should not be wasted; they add to the nutritional value. Any carcasses for sale should be neatly arranged on trays in refrigerated

display cases. Sprigs of parsley around the carcasses add attractiveness. It is usually better, however, to cut up domestic rabbits and sell them in special cartons. Rabbit meat for freezing is ordinarily cut up ready for use. Carcasses should be chilled overnight before being cut up.

The small fryer rabbit may be cut up, ready for the frying pan, into seven pieces, by means of a knife or a band saw. A carcass cut into this number of pieces, with the heart to the left and the liver to the right, is shown in figure 27, *A*. A cleaver should not be used, as rabbit bones splinter easily.

A band saw for cutting up rabbits prevents the splintering of bones and speeds up operations. More portions, as well as portions of more uniform size, can be cut with a band saw. Suggested cuts for larger fryers are shown in figure 27, *B* and *C*. The major points of



B81592

Figure 27.—Rabbit carcasses cut up for the frying pan. The heart is to the left and the liver to the right of each carcass. *A*, Carcass of a small fryer rabbit cut into seven pieces. *B*, Carcass which has been cut with a band saw into uniform pieces. *C*, A larger carcass cut into nice portions for individual servings.

separation are small of back, extreme front end of large muscles of the back, and just back of front legs. The hind legs are sawed apart and each leg is divided into two nearly equal portions by sawing crosswise from base of tail. The loin may be cut transversely into two, three, or more portions. The loin may also be cut into individual servings approximately 1 inch thick (fig. 27, *C*). Each portion may be rolled and skewered. The loin split along the backbone fits nicely into cartons. This is the preferred method of cutting in some localities. The rib portion (just back of front legs) is left entire but may be touched with the band saw along the backbone on the inside just enough to permit

the piece to be spread out in the frying pan. The front part of the carcass is split into two parts, the legs being left attached.

Other methods of cutting are equally satisfactory.

A neat, sanitary package for the carcass is a paraffined box with a cellophane window. A box 9 inches long, 4 inches wide, and $2\frac{1}{2}$ inches deep is right for a fryer carcass weighing $1\frac{3}{4}$ to $2\frac{1}{4}$ pounds. The cuts should be properly arranged in the carton, with the loin, thighs, and liver exposed to view, to appeal to the eye of the purchaser. For the breeder who retails to home trade or furnishes butchers with meat that is to be consumed locally, a neat, sanitary, and inexpensive package can be made by arranging the pieces of a fryer on a paper plate and adding a sprig of parsley.

If the meat is to be frozen, the package should have an inner or outer special transparent sealable wrapping to prevent freezer burns and loss in palatability. Freezing surplus rabbit meat during the spring permits sales during the winter at higher prices.

Regulations governing the grading and inspection of domestic rabbits and specifications for classes, standards, and grades have been promulgated by the Department. For information, write to the Production and Marketing Administration, U. S. Department of Agriculture, Washington 25, D. C.

RABBITSKINS

Good rabbit pelts supplied in large quantities are in demand. However, many raw-fur buyers do not purchase pelts in small lots, as small lots are almost as expensive to handle as large ones.

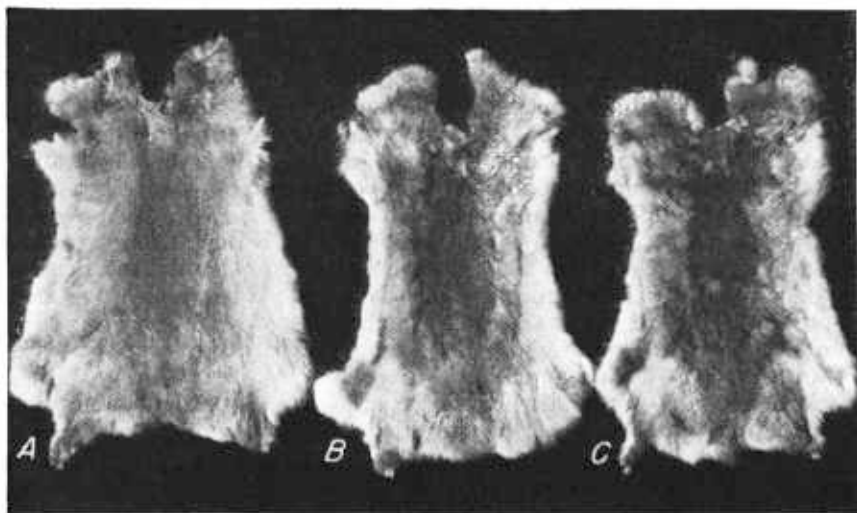
Developing a market for pelts depends much on the breeder's ability to furnish the types of rabbitskins required by the fur trade and to organize central collecting agencies that can accumulate pelts and sell them in large quantities. Rabbit breeders with small numbers of skins usually are not in a position to sort and grade their skins, but they should combine their shipments so as to market large quantities at one time. The profits in some cases have gone to middlemen who buy skins from breeders at low prices and sell them in larger quantities at much higher prices.

Enormous quantities of wild rabbitskins are used annually by the fur trade, largely because the processes of plucking, shearing, and dyeing have been so perfected that good imitations of more expensive skins of other animals can be produced (fig. 28).

Only well-furred skins should be used by fur manufacturers. The poorer grades can be used for making toys, specialty articles, and hatter's fur. Unprime skins, however, are frequently used by manufacturers of cheaper rabbit coats, which never give satisfaction to the wearer and tend to discredit garments made from the better rabbitskins. White skins find the most ready market with the fur trade because they can be used in their natural color or dyed any shade. Large skins grown on the more mature rabbits during the colder months are the most suitable for the fur trade.

More money from domestic rabbits is made, however, by selling them just as soon as they have reached a marketable weight. At this age the skin is small, the leather lacks strength, and the fur too frequently appears flat, mats, and does not have the good wearing qualities of fur from older rabbits. Most domestic rabbitskins taken from animals

up to 4 months of age have a rough uneven appearance (fig. 28) owing to the contrast between old fur only partly shed and patches of ingrowing new fur. The new fur grows at a different angle from the skin, and the fiber has a different structure. If when stroking a live rabbit from the tail toward the head, an intermixture of long and short hairs is noted, and if the fur flows unevenly under the hand, the skin is unprime. A desirable skin should feel dense and full and the fur should flow back promptly and evenly when rubbed toward the head. Skins not having this "fly back" are soft and the fur is easily matted.



D11186

Figure 28.—Skins dressed "long hair" from New Zealand Red rabbits. These skins have been rubbed from tail to head to raise the fur. *A*, Fully prime skin, *B*, prime skin on the back only; *C*, skin with all areas unprime. The rough sides of *B* and *C* indicate unprimeness due to shedding or molting.

Domestic rabbitskins vary greatly in density and quality, depending on the degree of care that breeders take in making selective matings. Good fur can be produced on an efficient meat-producing animal by selective mating. Better skins command higher prices. Improved methods of dressing may make the fryer rabbitskin more readily usable in fur garments.

CURING

While still warm, skins to be cured should be placed flesh side out, the fore part over the narrow end of wire or board formers or shapers. Care should be taken to remove all wrinkles. A satisfactory skin shaper can be made from No. 9 galvanized wire 5 feet long. This equipment has been called a "stretcher," but the term may give an erroneous impression; it is not desirable to stretch the skins unduly, as this tends to weaken certain parts and also open the fur. Skins should be so arranged on the shaper as to have the four legs on one side (fig. 26) and thus avoid any possible injury to the back fur, which is the most valuable. On the day after skinning, the pelts should be

examined to see that the edges are drying flat, that the skin of the front legs is straightened out, and that any patches of fat are removed.

Rabbitskins should not be dried in the sun or by artificial heat, and they should be hung in such way as to have the benefit of free circulation of air. All skins must be thoroughly dry before being packed. If they are not to be shipped for some time after being dried they should be hung in loose bundles of 50 in a cool, dry place away from rats and mice. If they are kept any length of time in a warm climate or during summer they should be sprinkled with naphtha flakes. Salt should never be used in curing rabbitskins.

PACKING AND SHIPPING

To avoid spoilage or damage in transit, care should be taken in packing skins for shipment.

So far as possible skins should be kept in the same shape as when removed from the form. Each one should be examined carefully to make sure that it is properly dried. A moist pelt or one that has patches of oily fat on it should not be packed or shipped. Large quantities of skins may be made up into bales.

Every two or three layers of skins, as they are being packed together, should be sprinkled with flaked naphthalene or paradichlorobenzene to keep out insects that might cause damage. When a bale has been made up it should be covered with burlap, sewed with strong cord or binder twine, and marked. Skins should always be well protected when shipped. Smaller quantities may be shipped in gunny or feed sacks. Wooden boxes should not be used for shipping rabbitskins; the weight would add materially to shipping charges.

SORTING AND GRADING

If the best prices are to be obtained, rabbitskins must be carefully sorted and graded for quality, color, and size. No mixed shipments should be offered, for if good and poor skins of different sizes and colors are mixed, the entire shipment is usually accepted at the price of poor skins.

Raw-fur buyers usually grade rabbitskins as firsts, seconds, thirds, and hatters, though many buyers have their special grades. Firsts and seconds may be divided into five classes, based on color—white, red, blue, chinchilla, and mixed. Some furriers also grade firsts and seconds as large, medium, and small. If quantities permit, white, red, blue, and chinchilla skins should be packed separately by colors, whereas skins of all other colors may be put together.

Firsts are prime pelts that are large, properly shaped and dried, having all the hair and underfur intact, and the skin side free from fat, flesh, spots, streaks, and cuts. The thicker and denser the underfur on a pelt, the more valuable it is and the better price it will bring.

Seconds are pelts that have shorter fur and less underfur than firsts. The colored skin usually shows dark spots or streaks, and sometimes large black splotches. These markings do not show readily on white skins. Seconds also include pelts that are improperly shaped and dried, that have been damaged in shipment, or that show poor spots where the skin has been pierced or the fur is short or missing.

Thirds are pelts with short fur and thin underfur and those from animals too young or those that are shedding. Thirds are of no value

to furriers, but they are used in the manufacture of toys, specialty articles, and felt hats.

Hatters comprise all skins that do not meet requirements of the other grades. Pelts that are badly cut or otherwise mutilated, and poorly stretched and dried are classed as hatters.

TANNING SKINS FOR HOME USE

Rabbitskins to be sold should not be tanned before shipment; fur buyers prefer to get them in the raw state. If intended for home use, however, they may be tanned by the methods described below. They should not, however, be expected to compare favorably in appearance and pliability with products of a tannery or factory operated by experienced workmen and equipped with modern machinery.

In tanning, the first step is to get the skin thoroughly softened, clean, and free from flesh and grease. If cased, or whole, slit the skin down the middle of the belly and then soak it in several changes of clean, cool water. When it becomes soft, lay it over a pole or board and work over the skin side with a coarse file or dull knife, breaking up and removing the adhering tissue, flesh, and fat, and at the same time working the grease and oil out of the skin. It is useless to start tanning until all the tissue, fat, and grease have been removed and the skin has been made uniformly soft and pliable.

The thickness and condition of the pelt determine the length of time a skin must be soaked. Some skins require 2 or 3 hours and others longer. A skin should be soaked until it is soft, but it should not remain wet longer than necessary, as the hair may start to slip. When the skin has been thus treated and is somewhat softened, it should be worked in lukewarm water containing 1 ounce of soda or borax to the gallon. Soap added to the water is also helpful in cutting the grease and softening and cleansing the skin. After the skin has been rinsed thoroughly in lukewarm water, the water should be squeezed out, but the pelt should not be wrung. Finally, the skin should be worked in gasoline, which should remove the last particles of dirt and grease. It is then ready for tanning.

There are several methods of tanning rabbitskins. Directions for using two of the more successful methods—the salt-acid and the salt-alum processes—follow.

SALT-ACID PROCESS

The salt-acid formula calls for a solution made of 1 pound of common salt and one-half ounce of concentrated sulfuric acid to each gallon of water. Dissolve the salt in the water and carefully pour in the acid while stirring. Make and use this tanning liquor in glass or earthen jars or wooden vessels, never in metal containers of any kind. When pouring in the acid, do not inhale the fumes given off. Be careful also not to get any of the strong acid on the skin or clothing. If by accident any acid does get on the skin, wash it off immediately with a 5 percent solution of sodium bicarbonate (baking soda).

As soon as the salt-acid solution has cooled, it is ready for use. Put the cleaned, softened skin in the solution so that it is entirely covered. After 1 to 3 days, during which it has been stirred frequently, remove it and rinse in clean, cool water. Then work the skin for about 10

minutes in a solution of 1 ounce of borax to 1 gallon of water. Rinse again in clean water and squeeze (but do not wring) as dry as possible. Work the skin a few minutes in the hands by rubbing and pulling, then tack it out flat, flesh side up, apply a thin coating of grease or oil, and let it dry. Fresh butter, neat's-foot oil, or olive oil are good for this purpose.

When the pelt is nearly dry but still damp, start working it with the hands, stretching it in all directions, working the flesh side over the edge of a board, and pulling it back and forth as if shining shoes with a cloth. If the skin is rough, it may be smoothed by working it over a sandpaper block. This also helps to make it soft and pliable. Much of the success in producing a soft, pliable skin depends upon this repeated working, which must be done while the skin is drying out and not after it is dry.

If the skin is not soft enough when dry, dampen it and work it again as before. If still greasy, give it a hasty bath in gasoline. A final cleaning, accomplished by working the skin in warm, dry, hardwood sawdust, is beneficial and will add to the luster of the fur.

SALT-ALUM PROCESS

The salt-alum formula calls for 1 pound of ammonia alum (ammonium aluminum sulfate) or potash alum (potassium aluminum sulfate) dissolved in 1 gallon of water; and 4 ounces of washing soda (crystallized sodium carbonate) and 8 ounces of common salt dissolved together in one-half gallon of water. Pour the soda-salt solution slowly into the alum solution, stirring vigorously. Mix the combined solution with enough flour to make a thin paste, first mixing the flour with a little water to prevent lumps.

Smooth out the skin, cleaned and softened as previously described, and tack it, flesh side up, on a board. Coat it with about an eighth of an inch of the tanning paste; then put paper or sacking lightly over the paste. The next day scrape off most of the paste and apply another coating. At intervals of a day repeat this application two or three times, depending on the thickness of the skin. Only thick skins from mature bucks will need as many as three applications. Leave the last coating on for 3 or 4 days. Finally, scrape off the paste, work the skin in borax water, rinse and squeeze it, and then stretch and work it over a board in the manner described for the salt-acid process.

The salt-alum process is widely used and is considered slightly better than the salt-acid tannage, although alum-tanned skins often come out stiff and hard and require much working to make them soft and pliable.